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The Golden Ticket: How Blockchain Technology can be Implemented into Event Ticketing

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The Golden Ticket:
How Blockchain Technology can be Implemented into Event Ticketing

A Capstone Project Submitted in Partial Fulfillment of the
Requirements of the Renée Crown University Honors Program at
Syracuse University

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and Renée Crown University Honors
Spring 2019

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Abstract

When the group/individual named Satoshi Nakamoto first conceptualized blockchain in 2008, it served as the underlying foundation to the cryptocurrency Bitcoin. In the years following, cryptocurrencies alike experiences massive gains in profitability; however, after the bubble had burst organizations began to look at the technology from a more academic standpoint. It was quickly found out that there is a massive application for blockchain in almost all sectors of industry from bulk stores (Walmart) to banking (IBM). This paper will explore how blockchain technology can be implemented into event ticketing, more specifically concerts. The current landscape of the industry is under scrutiny as previous events led to a gap in trust and security between consumers and businesses. The ticketing sector is being exposed to the advantages of integrating the emerging and evolving technology as more companies begin to take interest in how blockchain can improve business. The willingness of ticketing corporations to adopt the technology will help mend relationships with consumers, provide more protection, and provide a more secure and engaging experience for consumers.

Executive Summary

This project, since the inception of it, has taken on many different forms and was stretched in many different directions. After finding an intellectually stimulating, current, and important technology that could be implemented into event ticketing, I began forming what topics I wanted to cover. *The Golden Ticket* will give an in depth analysis of blockchain, how it works, how it can be applied to ticketing, and the current landscape in ticketing. (Un)Fortunately, the past two or so years have been filled with a shift of power and focus in the ticketing industry. Ticketmaster was accused of skeptical business practices, Ticketfly had one of the largest data breaches on record, the use of bots (automated purchasing software) has increased, and there was seemingly a large gap in trust between these companies and consumers. The project culminated with a sample code of what a blockchain ticketing interface could look like. This portion is where the technology meets the music.

There is an argument to be made for the adoption of blockchain technology in modern day event ticketing. Consumers can now download their ticket to their smart phone to gain access to events of different sizes. From baseball games to a concert at the Brooklyn Bowl patrons can simply store their ticket in their mobile device. This new aspect to ticketing has led to some people forging QR codes for tickets. As the industry advances and becomes more technology driven, there will always be people who will try to work around the system. The research provided ranges from Federal Government standards on anti-trust laws, to ticket sales data recorded by Pollstar, to investigative reports. This myriad of information has further ameliorated the reason as to why there should be more secure measures for ticketing across all venues and entertainment.

For the technology aspect of the project, source material from Syracuse University's IST 400: Blockchain Management course, third party solidity coding labs, and consulting with blockchain experts aided in the creation of the ticket interface. There was a large period of trial and error to make sure the

code ran as intended with no errors or redundancies. Having met with a few different blockchain coding experts, the end result ended up being more simple than initially anticipated.

In the wake of Ticketmaster's reselling tickets practice, Live Nation being accused of pulling show's because vendors don't want to use their ticketing software, and the Ticketfly data breach there has been an expanding gap of trust and security. There is seemingly no end to the amount of live entertainment events annually, and they are getting larger and more global. While this is going on, a technology that is centered around data integrity and decentralization has become an increasingly hot topic. Other business titans such as Walmart, IBM, and American Express are beginning to implement blockchain into their operation practices Although there are many positive externalities to blockchain, this could be an item of "low hanging fruit" or something that a company can take on and immediately begin to see benefits.

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Advice to Future Honors Students

Push yourself, keep cool, and you'll get it done. I promise.

Rock and Roll,

Jack H. Singer

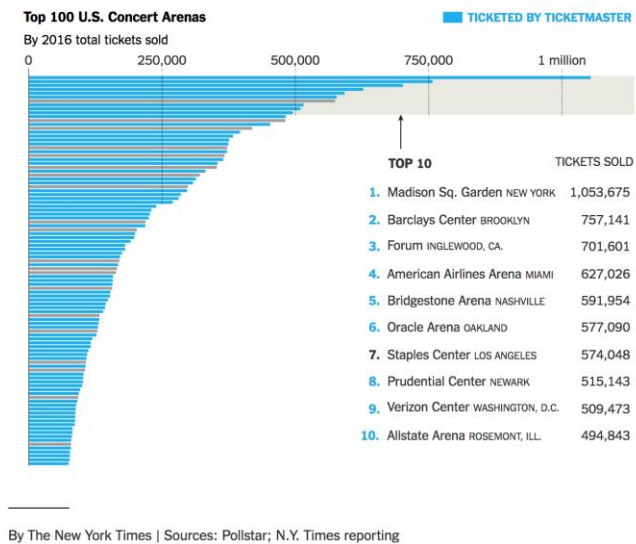
Chapter 1

Introduction

Annually, there is a plethora of live events for people of all ages to attend. Legacy acts such as The Rolling Stones, Dead & Company, and Elton John are headlining world-wide arena tours. In the same vein, there is a new dawn of musicians on the rise who relentlessly tour across the world playing clubs (250-1,000 capacity), theaters (1,001 - 2,500), and concert halls (2,501 - 4,000). Each major city has several venues of all different sizes and crowds who are eager to attend such events and an equal amount of performers who want to put on a show. With these two forces working in tandem with one another, an immense amount of tickets are being moved. In a handful of instances, the demand vastly exceeds the supply and fans can be left empty handed, in this event they may go to a secondary (possibly tertiary) market or vendors and pay a significant surge price. This price could be anywhere from a 50% to 500% gauge and none of those profits are seen by the proprietary ticketing company, managers, agencies, and promoters. Along with this is the risk of purchasing a fraudulent ticket which is a seriously unfortunate event where people take advantage of consumer's desire to be a part of a specific event. According to Pollstar Magazine, a music industry focused periodical, the average cost of an event ticket has increased to \$46.69 (4.2% higher than last year) (Valenti, 2018). While this number may not seem extreme, the annual rise in price is deterring fans from seeing their

favorite artists. Since the 1990s artists have noticed that those in the best seats in the house procured their admission from scalpers and paid significantly higher prices. This caused artists to begin price tiers to see more profit generated from ticket sales in hopes to curb ticket scalping.

The current landscape of ticketing is dominated by a few major players such as Ticketmaster and Ticketfly. These are two major vendors who in the past five years have been in the news for rather unfortunate happenings such as



collusion and data breaches. Ticketfly in the summer of 2018 was subject to a massive data breach; it was reported that approximately 26 million people's accounts were compromised. Fortunately for Ticketfly, no pertinent data was taken such as credit card information and social security numbers, however, "names, addresses, emails, and phone numbers" were leaked (Schatz, 2018). As the realm of the internet, for the most part, remains unregulated and sans legislature protecting individual privacy (domestic, not foreign) is a huge concern for many users of the internet. Over the past year, Ticketmaster has been scrutinized. First, in 2010 the ticketing juggernaut was merged with the promotion company Live Nation. For many independently owned venues and smaller ticketing platforms this is viewed as a vertical monopoly; while the department of justice initially thought that the merger would actually boost competition and possibly decrease overall ticket prices, the two entities have only amassed more power.

Ticketmaster is now the soul ticket provider for "80 of the top 100 arenas" according to a New

York Times Article referencing pollstar data (Sisario, 2018). The company sells millions of tickets annually for the years biggest artists in the largest arenas across the world. Ticket prices and the accompanying fees have only increased and there is lack of competition in the market. Along with providing for venues, Live Nation also manages several hundred artists some of whom are the highest grossing annually. It has been reported that Live Nation has supposedly pressured venues into using their subsidiary platform Ticketmaster or else they would cancel concerts. More recently, it was discovered that Ticketmaster has been colluding with scalpers and turning a blind eye to people who have several hundred Ticketmaster accounts and are buying up swaths of tickets to then resell. The scalpers then move their tickets on a Ticketmaster product called TradeDesk; here they are able to collect the fees associated with the resale ticket. According to the Canadian Broadcasting Corporation, Ticketmaster for the upcoming Bruno Mars tour, was able to possibly “collect up to \$658,000” (CBS, 2018). Ticketmaster has since denied these accusations.

Now more than ever there is an expanding gap of security and trust between ticketing companies and their consumers. On one front, user information may not be protected with the utmost integrity and their privacy is at risk. On the other front, consumers are being subjected to high prices from ticketing and promotion conglomerates. There is no end to live music in sight and the ticketing field needs to be subject to a more watchful eye. According to Moore’s Law the number of transistors that can fit onto a circuit doubles every year. This gives technology the capacity to become stronger, more agile, and faster every two years. There have been several technologies implemented into the event ticketing space such as mobile ticketing, storing admission stubs into virtual wallets, and creating a queue to purchase tickets online. More broadly, several new technologies have been integrated with the events themselves such as VR

concerts, coordinated house RFID light wristbands, and social promotion. There is a huge space for technology in ticketing; in the wake of the crypto-currency bubble, there has been a lot of speculation about the application of blockchain technology into businesses. Large companies such as Walmart have integrated the technology to help better track inventory and product information. There is an application for blockchain in the ticketing industry, security of information and data would increase, there would be proportionately more trust in these ticketing companies that no grey-area business is taking place. There are currently a few blockchain ticketing companies in the field such as Blockparty, Aventus, and Upgraded . With the right focus, blockchain could be a powerful tool in the event ticketing realm that could give consumers a fair opportunity to purchase tickets and empower them to continue to cultivate the live music sector.

Chapter 2

The Landscape

Although the Live Nation and Ticketmaster merger was dubious at first, skeptics would be proved to be well founded in their assumptions. When news of the merger broke, a great amount of the entertainment industry voiced their concerns. Prior to the execution of the deal Ticketmaster was forced to license its ticketing software to Live Nation's competitor AEG and after five years they could purchase the software, create their own, or partner with a competitor. The ticketing company was as well forced to sell Paciolan, which is now owned by Learfield Communications. Other terms included that Ticketmaster has been "barred from retaliating against venue owners who use a competing ticketing service." (Pelofsky, 2010). Despite some people's reluctance, the merger passed and Live Nation and Ticketmaster would assume dominance in the event ticketing industry for the foreseeable future. The Federal Trade Commission (FTC) states in their 'Guide to AntiTrust Laws' 'Mergers' section that some mergers may "lead to higher prices, fewer or lower-quality goods and services, or less innovation." This is an externality that has plagued event ticketing since the merger in 2010. Ticket prices are increasing, competition is falling behind, and innovation is few and far between.

In July of 2018 a ticketing convention was held in the Caesar's Palace Hotel in Las Vegas, NV. At this convention, reporters from the Toronto Star had gone undercover as ticket scalpers to the event and spoke with Ticketmaster representatives; when the reporters approached the Ticketmaster resale booth, they were told by a sales executive that, "I have brokers that have literally a couple hundred Ticketmaster accounts." (Cribb, 2018). This statement goes directly against the company's own rules and regulations of buying over the amount of allocated tickets per customer. Each event has a maximum amount of tickets one consumer can purchase at a given time. Ticketmaster and TradeDesk, although the same company, did not communicate or interact in any sense, the sales person went so far as to refer to the relationship as 'church and state' (Cribb, 2018). This practice of allowing scalpers to have several accounts gave Ticketmaster a secondary source of revenue. On top of the fees and commission they take from

on-sale tickets, they were making more money from the fees of their ‘verified resale’ tickets. This practice, while not illegal, is making consumers feel duped and forced into purchasing after market tickets at higher prices. Ticketmaster since the 2010 merger has been, and will continue to, cultivating power and can do whatever they please so long as demand exceeds the supply. If they do not choose to stop their own antics, the only entity that would prohibit such activity would be the government.

In October of 2018 the FTC announced a public ticketing workshop. Ticketmaster issued a statement, as all eyes were on them in the wake of the event announcement, saying that “...this is not a probe.” (Brooks, 2018). This news follows all of the controversy surrounding the ticketing giant as people on all sides of the industry have expressed concern. The Federal Trade Commission said the following about the March, 29th, 2019 workshop, “The online event ticket industry has been a frequent topic of consumer and competitor complaints, and FTC staff is seeking public input in advance of the workshop, including possible discussion topics and potential participants.” The goal of the event is to bring in consumer advocates, company executives, and government officials and educate them on the ethics and current issues in the market.

Beyond the obstacles that Ticketmaster is creating, other ticketing companies, while not at fault for suspect practices, have been suffering and consumer security and trust is being diminished. Ticketfly is another first party ticketing vendor that is owned by Eventbrite. In June of 2018 news had surfaced that the company had suffered a massive data breach and all operations were immediately suspended until the company addressed the problem. They reported that they became aware of unauthorized access to the platform on May 30th, 2018. Following this the company had stopped all operations and swiftly addressed the problem; credit and debit

card information and other financial credentials was not accessed by the hacker. The only things that were leaked were names, addresses, emails, and phone numbers were taken. The scope of the impact was approximately 27 million accounts and the company reassessed their security protocol as well as made all users reset their passwords as an extra measure (support.ticketfly.com, 2018). This incident was listed by Fox Business magazine as one of the biggest data breaches of the year along with Facebook, Equifax, and Under Armour.

Despite no payment information being taken, this data breached scared consumers. Privacy is increasingly a popular topic as more and more companies suffer from data breaches or are treating the information without the utmost integrity. These events in the ticketing market has whittled away at the consumer's trust and security with these companies. Ticketmaster has made claims that they are going to address any problems the company has with reselling tickets. They have as well acquired a blockchain company called Upgrade; their service provides another layer of security as tickets are turned into interactive digital assets and encrypt the ticket barcode. This is not a marketplace to purchase the tickets, although you can seamlessly transfer the ticket rights, it is simply an extra measure to help Ticketmaster prevent fraudulent sales and activity.

Chapter 3

Interviews

In the past five years blockchain has captivated the interest of millions of people across the globe. Cryptocurrencies reached all time highs (but have since decreased), and the frenzy around blockchain continued as people saw applications for the underlying technology. Primarily, blockchain has a decentralized property which means that no central body or organization has control over the network. This structure provides for ample security, user privacy, and increased trust. Blockchain is comprised of a block and chain. Each block is where information is stored and each block is connected via a chain. These groups create a connected system that allow for transactions to be made on the system through a unique token or crypto currency. Any time that an author makes a change, all the other machines on the chain are updated with the new information as well. There are two different means of tracking who has done work on a specific block; these protocols are proof of work and proof of stake. Proof of work is when a person solves a complex algorithm and a reward is given to them (also called mining). Proof of stake is when a person on a chain is deemed the creator of a block based on their wealth. Blockchain is as well immutable or once a change is made it cannot be undone, only another transaction can be executed that results in the previous one being a zero sum. Also, old versions of a file cannot be deleted which keeps a record of changes made (this helps prevent fraud) it is referred to by Richie Etwaru as the rings of a tree, "Each ring is an immutable record of the tree's growth during one year. Once a ring is grown by a tree, it cannot be altered." (Etwaru, 125). This technology can bring a much needed boost in data security, consumer trust, and equality to the event ticketing landscape.

One of the biggest features of the blockchain fabric are smart contracts. For businesses, this provides a rules of engagement for users on the chain. The white paper for Ethereum describes them as, "...systems which automatically move digital assets according to arbitrary pre-specified rules." (Ethereum, 2014). This contract allows users to move an object, in this case a ticket, from one person to another only if certain rules and requirements are met. Innately, smart contracts are designed for security on the network and provide users with confidence no one is up to anything malicious on the chain.

With all of the recent news about Ticketmaster and the Ticketfly data breach people looking to buy tickets for an event are right in not trusting the current landscape of the ticketing industry. Recently, Upgraded, a blockchain ticketing platform was purchased by Ticketmaster. The app allows users to purchase a ticket to a concert or sporting event and covers the tickets barcode until the event's doors open and the user is within range of the venue. The app also allows users to sell their ticket on a secondary market or transfer the stub to a friend who will have immediate use on their mobile device. Now that big companies are starting to adapt the technology there will most likely be an increase in others adopting the technology. There is a place for this technology to make a substantial difference. With blockchain fraudulent tickets would be few and far between, customer information is secure, and most importantly everyone would have an even playing field with regards to on-sale.

In the summer of 2018, amidst extensive research on my thesis, I had the opportunity to be an intern in the Artist Development & Touring department at Atlantic Records. On a daily basis I would have to synthesize radio data, organize artist itineraries, book hotels/travel, create budgets, and keep track of artist touring. A big part of my job was tickets and making sure they are the right price, taking care of company ticket buys, and handling on-sale. I was fortunate

enough to work for Harlan Frey, the Senior Vice President of Artist Development and Touring. When I had mentioned my project to him he was open to sitting down with me to talk about technology in the ticketing sector as well as some of the woes of the business. When we spoke about fake tickets and unfair practices Harlan had the following to say:

“The more demand, the hotter the show, the higher chance there is a fake ticket market. It is hurtful to the fan community because it makes for distrust between the artist and the fan...The more it hits me is in the scalping market and those who utilize tech to get tickets at face value and sell them for three or four times the amount. In those cases, managers, agents, and promoters do not see the money. Every artist has their own view on how tickets to be sold. So do agents and managers. Some want tix in the hands of fans and some just want to sell-out the show no matter the cost. If that means brokers and bots create the perception of ‘heat’ some managers and artists are ok with that.” (Frey, 2018)

Harlan firmly believes that there will be something to more firmly control the fake ticket market. If that product cannot completely get rid of fake tickets then it surely will control it as more and more unique identifiers come up. The verified fan presale is a good measure to ensure that fans are getting tickets and scalpers are not buying mass quantities and reselling them. This helps bridge the trust gap as it incentivises people to subscribe to their favorite artists and have an unobstructed chance at purchasing tickets. Harlan believes that at some point the fake ticket market will be eliminated or greatly lessened, he said:

“I do not know when that is coming but I also never thought in a million years streaming would be where it is today and piracy would be all but eliminated.

Maybe it will never be fully eliminated but at least it will be under control.”

(Frey, 2018)

With company executives understanding that there is an issue with event ticketing, there will be more notice placed on making sure fans are able to purchase tickets in a safe, secure, and legitimate environment.

On the other side of the conversation, there is equally as much optimism about the emergence of blockchain in ticketing. I was fortunate enough to have gotten in contact with Jason Berger, the founder of 1800-All- Show. While working at Ticketmaster in the late 80’s, Jason realized that there is an un-catered market: tickets to exclusive or “hot” events. All show primarily works with events in the northeast market and provides tickets on the secondary market for, more often than not, a more competitive price than other sources. Over the past two decades, Mr. Berger has taken it upon himself to deliver a top quality service and continue to adapt to new technology trends; for one, his service is tapped into the inventories of other markets such as Stubhub, Vividseats, and Seatgeek to name a few. When discussing how he uses technology to his advantage, he said, “We do a lot of backend tech to help facilitate the delivery of tickets. Tech for us really helps execute sales and delivery. We work with companies who have online marketplaces...” (Berger, 2019). Mr. Berger’s services watch over the values of tickets for events and when a customer is ready to purchase, they always look for the cheapest, legitimate option with the best seats available. This is a different approach than what most do; a bulk of scalpers simply buy as many tickets as possible (most likely using a bot or some regulated means) and then flood the market for a large markup. Through his use of technology Jason is able to procure tickets for any event for a lower markup than other mediums of exchange:

“We share technology that all the major exchanges and brokers share. We get real time feeds of their inventory. It benefits the consumer by this: we could provide tickets from all resellers for lower prices. They charge at least 27-30% mark up where as our markup is 20%.” (Berger, 2019)

Unlike other markets, All Shows has a live pricing system so they are able to get the customer the best deal possible.

Although Mr. Berger’s company is not a blockchain centric company, he is well versed in the technology as he has been watching its rise in popularity. When prompted with, “Do you think blockchain has a practical application within the ticketing sector?” he responded with:

“Yes, very much so. It can help in a lot of areas; it will definitely help prevent buyer fraud (people using fake or stolen credit cards), it would help in terms of knowing the consumer who is buying it, being able to verify a fan is getting a ticket.” (Berger, 2019)

I found his response, although concise, interesting in two different ways. He notes what would be one of the primary functions of blockchain in ticketing, preventing buyer fraud. Blockchain will help make sure that the people buying the tickets are fans who want to attend the event, not malicious resellers who are looking to make a dollar off of exploiting other people’s wants and interests. However, his second statement is one that is a big bonus for businesses; knowing who the customer on the other end of the ticket sale will help collect valuable data. Despite people yearning for privacy on social media and other platforms, knowing age demographics, geographical location, time spent getting the ticket (add to cart to checkout), gender, and customer history can help businesses (agencies, management, record labels, venues) better

understand the consumers. This will also help provide access to future events to consumers through email notifications, artist presales, venue presales, and other fan oriented programs.

The final interview I conducted was with Keith White, Chief Technology Officer at Paciolan. Currently, Paciolan is one of the biggest ticketing enterprises in the United States offering primary ticketing for sporting events and concerts. Wasting no time, we spoke about emerging tech in the sector and discussed the potential use of biometric means to protect customer's tickets. Fingerprint ID and face scanning is technology that is standard in most cell phones and laptops. Mr. White said, "This will also help with security in the sense that they will know who is in the venue. Fingerprints and face scans will be pivotal." (White, 2019). Above just being a measure for customers, the security aspect of this technology will help venues know who exactly is in their space. Unfortunately, events such as the Route 91 Harvest Festival shooting (Las Vegas, NV), The Eagles of Death Metal terrorist attack at the Bataclan (France), and the suicide bombing at the Manchester Arena during an Ariana Grande Concert occurred and the need for bolstered security at high capacity events has become larger. With regards to fake ticketing, Keith does not see an end coming to the fraudulent market, "Think of it as currency, even as it is now you can counterfeit it but it has become difficult to do so...But like currency, as long as there is value to something people will try to fake." (White, 2019). The analogy he made sums up how fake ticketing will continue despite whatever measures are made to prevent the manufacturing of forged tickets.

Most of our interview time was spent talking about how technology will change the ticketing landscape. Not just today, but as time progresses and more advanced means of production come forth ticketing will be a dynamic, ever changing field. Before getting into blockchain, we spoke about bots and their impact on how consumer's purchase access to events.

“ Are bots increasing, yes! That game has been going on for decades. As we get more sophisticated they get more sophisticated. I worked at ticketmaster for 7 years, I know all the folks are trying to fight it. We have all gotten better but to be honest I do not see an end game there. I think that it is going to be an ongoing effort to combat this. People have tried legislature, technology, business engagement, presale registration. There are ways to cut it down but there will be no end.” (White, 2019)

Mr. White brings up a great point. Akin to ticketing always becoming more advanced because of technology, so will bots. The ability for companies such as Ticketmaster, Paciolan, Ticketfly, and other first party vendors to determine that a fan, and not a bot or scalper, is buying the tickets is getting more difficult. Everytime a ticket is purchased there is always a captcha which bots can now get around, sometimes faster than humans. The automated aspect of bots is able to input addresses and credit card information at lightning speeds. However, there are automation extensions that consumers can use to compete with bots (similar to Mr. Berger’s approach).

We then proceeded to speak about blockchain integration and consumer trust with ticketing companies. The past 3 years have been filled with ticketing mishaps like the Ticketfly data breach, the surfacing of TradeDesk, and the ever increasing rise in cost of the average event ticket. One of the biggest qualities of blockchain is instilling trust between the business and the consumer:

“Eb and flow. There was a period of time where there was a big dis trust.

Ticketing companies have now shifted to be more fan friendly; but again you're dealing with a scarce commodity. If you have a hot ticket there are only so many of those and the demand will outweigh supply. Overall its peaks and valleys, if

anything I have probably seen it get a little bit better. Companies are now trying to direct fans, if fallen short of their goal, to legitimate market places to buy tickets.” (White, 2019)

Blockchain has yet to truly become the standard in the ticketing sector so looking at platforms such as Blockparty, Aventus, and Upgraded can only do so much with regards to understanding the trust gap. However, there is slowly a shift toward this infrastructure because companies truly do want fans to have adequate access to events. Bridging the trust gap will be a great step forward in how ticketing businesses interact with their consumers as well as how tickets are released publically. As Mr. White states, there will always be people who unfortunately are not able to get admission. There is a finite amount of space at each event but it is important that no one consumer is at an advantage. Blockchain would provide equity for consumers and clarity for the businesses.

Chapter 4

Feasibility

While there are blockchain mediums to procure event tickets, they lack the inventory (events) and ubiquity that other ticketing companies possess. What has made Ticketmaster and other first party vendors so powerful are the consumers. There are few outlets for people to have the same access to events as other parties with the added bonus of extra security. People often find themselves waking up early to buy tickets, and moments after the public on sale the event is sold out. In 2016, President Obama passed a law banning the use of bots to purchase tickets for events over 200 capacity; currently, the FTC and state governments are supposed to enforce the law which as well prohibits the sale of tickets purchased by bots across state lines (seemingly something that is often violated). This is all encompassed in the Better Online Ticket Sales (BOTS) Act of 2016 (congress.gov, 2016). This is a problem that sites like stubhub, vividseats, and seatgeek (second party) do not experience as they are not the proprietary source for admission to events.

As of now there are only a handful of blockchain oriented ticketing platforms such as Aventus and Blockparty. On Aventus, a consumer cannot even purchase an event ticket yet, and for Blockparty there are only a handful of events, mostly festivals. Ticketmaster purchased a company called Upgraded. Although this is not a purchasing platform, it is a blockchain driven

mobile ticketing wallet. This is a big step forward as the public will become more aware of the technology, how it functions, and other companies may begin to follow suit.

In the months of September to December of 2018 I took IST 400, Blockchain Management at Syracuse University. Eager to dive deeper into the idea of merging the up and coming technology with the ticketing landscape led me to create an in depth, mock blockchain ticketing company. When the project was in its nascent stages there were a lot of details to look into and decisions to be made. The first aspect to review was the current playing field, who the biggest players are, and how high (or low) is the barrier to entry. Currently Ticketmaster makes up 80% of the market share for event ticketing (Cohan, 2017). So, for a competitor to try to enter the first party ticket sales market is extremely high. Even though consumers often pay exuberant service fees, TicketMaster and Ticketfly have become household names in this space. The added confusion (for some) of what blockchain is and how it works also does not help up and coming enterprises.

Bearing this in mind, the second aspect to be reviewed, in great detail, is what type of infrastructure would this lie upon. Currently, there are two major means: Ethereum and the Hyperledger fabric.

Ethereum is more known among the public because of the crypto currency involved, Ether. During the crypto bubble, Ether hit an all time high of approximately \$1,350 in January of 2018. A little over a year later, the value of the coin is at \$120 (2/11/19). Despite a massive decrease in value, the previously record high numbers gave way to public awareness of the

underlying technology that

supported the currency. Ethereum,

as a technology was designed with consumer purchasing in mind.

Programs are written in a specific

language was built around smart

contracts, solidity. The program is

also fully transparent which is one

of the major tenets of which blockchain is built around (along with decentralization and

immutability). Seemingly, this is one of the better, if not the best option, for a first party,

blockchain ticketing company to use. According to the projects website:

“This enables developers to create markets, store registries of debts or promises, move funds in accordance with instructions given long in the past (like a will or a futures contract) and many other things that have not been invented yet, all without a middleman or counterparty risk.” (ethereum.org)

Ethereum has seemingly no ceiling for the opportunities that can arise, it is as well built with businesses and consumers in mind.

The other fabric to choose to use as an operating platform is Hyperledger. This is an extremely powerful resource for companies where information has to be private or a supply chain must be tracked. A lot of companies who use the network specialize in internet of things (IOT), medical records, and financial endeavours. The open source network is great for collecting data, watching over network activity, and security. Similar to Ethereum, Hyperledger has its own form of smart contracts called chaincodes which serve the same function (set of rules



for business to follow). The hyperledger team's goal for the technology is to "Provide neutral, open, and community-driven infrastructure supported by technical and business governance." (hyperledger.org/about). This statement is interesting in that they use the word 'governance' which seemingly detracts from what blockchain is, decentralized.

The two foundations are both great and provide specialized service. However, they both have their drawbacks. Ethereum has a scalability problem, something that a first party ticketing company would need. As more and more transactions occur on the network, the time it takes to execute will increase. Although there is no exact amount of transactions per second, people speculate that Ethereum can only process somewhere between 15-30 transactions per second. Ticketmaster has to deal with hundreds, sometimes even thousands of transactions per second which is no simple feat to accomplish. However, the creator of Ethereum, Vitalik Buterin explained that:

"with second-layer solutions such as Sharding and Plasma, the Ethereum network will eventually be able to process 1 million transactions per second and potentially more than 100 million transactions per second." (Young, 2018)

This is big news for the technology as more transactions per second could potentially increase the amount of buying platforms (such as ticketing) that use Ethereum.

Hyperledger also has some technical issues that would make it difficult for use in ticketing. Primarily it is a completely private network within a business, everyone on the network had to have been permissioned prior and this obfuscates transparency. Hyperledger is also not decentralized. The project is over sought by The Linux Foundation; this goes against the traditional pillar of blockchain being decentralized as there is once central body that governs. The system also does not support the use of a cryptocurrency and is mostly a collaboration tool

that creates blockchain frameworks. A lot of companies such as American Express, Deutsche Bank, Cisco, and IBM use the service for overseeing aspects of the supply chain and tracking records.

Ethereum would be a more suitable platform because it is specifically designed for transactions. With the advent of mobile ticketing, and an ever increasing amount of live events annually, tickets are exchanged more than ever. This constant movement from the first party, to the consumer, to potentially a secondary market or transferred would be best supported on a system that is smart contract centric and transparent. There would then be an increased amount of trust as consumers would then be able to verify transactions and authenticity. Despite the current issues regarding scalability, if Mr. Buterin's comments come to fruition the issue of slow transaction times and the amount of 'gas' (added money to expedite transaction process) would be all but nothing.

Chapter 5

Coding

The image shows the Remix IDE interface. On the left, the Solidity code for 'Golden Ticket.sol' is displayed, starting with 'pragma solidity ^0.4.24;'. The code defines a 'Ticket' contract with several functions: 'random()', 'createticket()', 'requesttransferticket()', 'approvetransferticket()', and 'confirmticketpurchase()'. It also includes an 'Owner' modifier and a 'person' struct. On the right, the deployment interface is visible, showing the environment set to 'JavaScript VM', the account '0xca3...a733c', a gas limit of '3000000', and a value of '0 wei'. Below this, there are buttons for 'Deploy' and 'At Address'. A section titled 'Deployed Contracts' shows a list of contracts, including 'Ticket at 0x692...77b3a (memory)' and its associated functions like 'approvetransferticket', 'confirmticketpurchase', 'createticket', and 'requesttransferticket'.

Pictured above is a rudimentary blockchain ticket that can be created and sent to a user. The user can then change of the ownership of the ticket if they so choose to. Using the platform Remix, I created two different smart contracts; one contract is the logic functions for the ticket, and the other is for a recipient.

In order to begin to code, the version of solidity in which someone is coding must be stated. Some programs have unique functions or different methods of achieving a similar goal. Once the version is established the first contract can be created. A smart contract is a list of standards that need to be

met in order to execute. Within the contract are functions and modifiers which validates the candidate for the transaction at hand. Lines 4-9 are the variables that are established prior to the functions such as event which are message the contract sends out to the user, uint or unsigned integer which represents a numerical value (ether/wei or barcode), bool or boolean value is a simple true or false value, and lastly address is a location in the transaction. After the values are established, the functions can start being created. The function in lines 11-13 generates a random, unique number with up to 256 integers. This is a private function that only the owner of the contract can see. Lines 15-20 state that the current owner of the ticket is the sender (person who created contract), the specific ticket I.D. is created, isPurchased (bool value) is required to be true, and if the recipient of the ticket does not have the right amount of Ether to purchase the ticket they are not allowed to purchase. In this case, the value of the ticket was set at \$50, approximately the average cost of a ticket. Lines 22-25 begin to undergo the process of changing the ownership of the ticket. Once the financial aspect meets the requirements of the contract, ownership is given to the purchaser and they now have the rights to the ticket I.D.. The following modifier, in lines 27-30, ensures that the msg.sender (or owner of the contract) is the original owner. The final functions, lines 32-35 and 37-40 respectively, approve the ticket ownership to be transferred and triggers an event for the user. The latter function confirms the purchase was made and ownership was transferred.

Although brief, the last function sets up a 'person' contract. This interacts with the 'Ticket' contract so there can be an exchange of an item. This function is for the demo specifically as I wanted to have the items engage with the contract. On the left hand side of the picture there is a box that reads "Deploy" and "At Address". While the contracts did deploy, I did not have the 'gas' or extra money added to expedite the transaction.

Chapter 6

Conclusion

This technology is here to stay. As time moves on, according to Mohr's Law, technology will only become more powerful and be able to handle more processes and transactions at once. With companies of a myriad of varieties developing their own blockchains the use and feasibility for its application in ticketing grows. Ticketmaster took the first major step for ticketing and blockchain; the big ticketing companies understand that there is, to a degree, some sort of a problem and blockchain can be a low hanging fruit. That is, it is something companies can adopt immediately, not be too difficult to grow accustomed to, and see results. Through all of the research gathered, and time spent coding, a first party, blockchain oriented ticketing company is feasible. Not only is it something that can be accomplished, consumers may feel more inclined to use such a service as they want their information secured and an even chance at procuring access to an event.

Further research for the application is needed, but the technology needs to develop further. Ethereum, which is a popular foundation for blockchain, can only handle 15 transactions per second whereas other payment methods can process several thousand transactions. That is the more transactions being processed, the slower the underlying technology will run. This is due in part to the technology being in its nascent stages; however, with time it will only be able to handle more requests per Vitalik Buterin. Once at the level required to fully execute an operation on a massive scale, there should be critical research done on how it improved company operating procedures, were customers retained, and if there was an influx of new customers because of the improved security.

After having been shut out of multiple concert on-sales and purchasing fake tickets on two separate occasions I felt as though there is a problem in event ticketing. People's claims of skeptical activity after the Ticketmaster and Live Nation merger, the Ticketmaster/Trade desk news, and the Ticketfly data breach all cemented my visceral feeling as though there is a gap in trust and security in between businesses and consumers in the ticketing industry. After revising my project a multitude of times, I had finally concluded that there is space for blockchain technology in ticketing. It would decimate or possibly even eliminate fake tickets and provide all consumers the same access to events by protecting against the use of automated purchasing software.

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