

INFORMATICS INSTITUTE OF TECHNOLOGY (IIT)**In Collaboration with****UNIVERSITY OF WESTMINSTER (UOW)****BSc. (Hons) in Computer Science****Final year Project 2019/2020****Literature Review****For****Appezite: Blockchain based online ordering, Order Ahead application and Webstore
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List of Abbreviations

APK – Android Package Application

IOS – Internet Operating System

O2O – Online to Offline

Inc – Incorporated

Mo – Monthly

App – Application

PoS – Proof of Stake

PoW – Proof of Work

PBFT – Practical Byzantine Fault Tolerance

DPOS – Delegate Proof of Stake

HF – Hyperledger Fabric

Chapter 2: Literature Review

2.1 Chapter Overview

This chapter reviews the background of online ordering focusing greatly on the food ordering and the current problems that are faced by the restaurants and their consumers. Furthermore, a possible solution, and a summarization will be discussed further with the aid of the existing systems for online ordering.

Furthermore, this chapter reviews research on scripting languages and discussions are focused on which of the scripting languages are more suitable for the build automation process. Finally, the chapter reviews the suitability of blockchain for online ordering systems.

2.2 Online ordering

With the rapid advancements of the technology in, people are increasingly adapting and making use of the internet for leisure activities, communication, and shopping which are few of the major activities that people use internet for. In present days the computer is the center source for almost all of the activities, as most of the currently available work is computerized for the ease of people. As people adapt to the new technologies businesses are forced to adapt to these technologies for the business to attract new customers and retain the existing customer base. Online ordering to the restaurant industry was introduced due to the introduction of Online to Offline (O2O) to the food and beverage industry.

The restaurant industry is one of the most competitive industries as the popularity of restaurants increase and new competitors increasingly come in to the industry. Some restaurants may not be able to keep up with the ever-increasing competition causing them to leave the industry or stay in the industry incurring losses. As pointed out by (HONG, 2016), the technological advancements in the industry have changed causing business models to grow and provide efficient systems that can help improve the productivity and profitability of restaurants using online food ordering. Online ordering has 3 perspectives, Websites, Order Ahead Applications, Aggregate sites. Investments made on food ordering is considered to be a luxury as small scale and medium scale businesses find it hard to invest on such solutions and operate successfully (Pantelidis, 2009). With improvements in the technology create solutions as Websites, Order

Ahead Applications, Aggregate site, Kiosks Terminals and many other solutions have been introduced, with the main aim of providing an online ordering, or food ordering systems for businesses.

As pointed out by (HONG, 2016) in areas which are equipped with a larger population, especially students, they tend to visit restaurants to have their meals but the busy schedules of people the traditional online ordering systems which is equipped in many of the restaurants put them at a tough spot as they have to wait in line for the order to be taken and another few more minutes or possibly hours till the order is prepared. With the people having busy schedules people are forced to find restaurants that allow them to order ahead of time as it will help them pick up the order as they arrive and continue with their other activities.

2.3 Online Ordering Systems

Online ordering can be defined as a “System that allows the customers to simply and conveniently order food online”. Online ordering systems can for restaurants can be an Online aggregate, Order Ahead Applications and Websites. Order Ahead Applications and Websites are businesses specific which means those applications only have a menu of one restaurant allowing customers to order ahead of time using that, while aggregate sites can be defined as a common place where businesses register allowing customers who uses the applications a wide range of restaurant choices to choose from. According to (Razak *et al.*, 2017) Food is one of the most popular products that sell online including fast food, bakery and vitamins.

2.4 Online Ordering Consumers

With the popularity of restaurants increasing, more restaurants have been starting to open up providing people a greater choice of food. With the increasing of restaurants, it has become a trend for the people to dine at a restaurant or get food delivered to their house rather than cooking at home. According to a survey done by (Toast Inc., 2018) the widely used online ordering method according to customers in the past year has been the restaurant websites with a percentage of 51%, leaving 38% online aggregate sites and 29% have been placed using an app for Restaurant or a food ordering service. However, it is difficult to provide conclusions with the above statistics, but as the tendency of people to order using websites mean that when a restaurant is lacking a website it will put the restaurant at a disadvantage since people prefer to order online.

According to a survey conducted by ToastTabs (Toast Inc., 2018) the most amount of orders by customers have been placed using the restaurants website.



Figure 1: Most popular online ordering systems

According to Figure 1, most of the orders are been placed using restaurant websites a restaurant without one may face difficulties in getting order as the newest trend in the 2019 is to get food delivered to the doorstep.

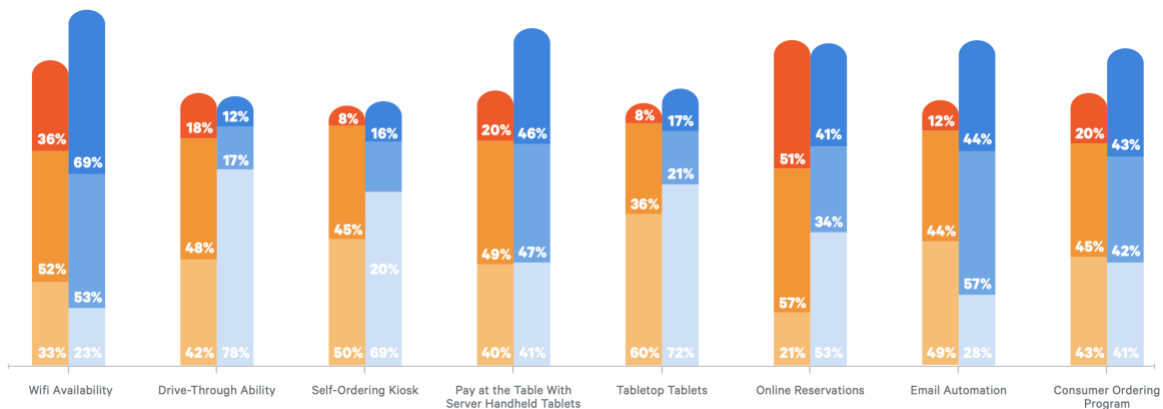


Figure 2: Most important technologies for guests

According to Figure 2 most of the customers expect online ordering, email receipt and confirmation automation and online reservation as key factors to improve their guest experience with the restaurant. According to (CardinalCommerce, no date) 75% of teens (GenZ) prefer online shopping over visiting the shop, and 54% of millennials have stated that ordering via a mobile application is easier than a website. They have also stated that the best way to reach GenZ consumers are to provide online ordering as the majority of the GenZ are comfortable with technology as technology is what they grew up with.

With the increasing trends in online ordering the proposed solution is a blockchain based application which has built in templates that allow the users to sign up via a merchant web

portal and add products to a business to be sold. The application will then provide the business with a test APK to test the features.

2.5 Existing System Analysis

In this section the existing solutions and other similar solutions will be analyzed providing the features, advantages and the pricing of each system. Furthermore, the remarkable systems will be discussed in detail, discussing on how they achieve the problem and the problems of the solution.

2.5.1 Order Ahead app and Online Menu App Builder

Name	Operating Platform	Cost	Application Type	Service
Apptizer	Android, iOS Webpage	\$500 – setup \$119/mo	Webstore	Standalone Order ahead
App institute	Android, iOS	\$65/mo	Webstore	Basic Order Ahead Application
Shoutem	Android, iOS	\$58/mo	Webstore, Android App, iPhone App.	Menu Application
Appy Pie	Android, iOS	\$72/mo		Aggregate Ordering builder
Toast	Webpage	-	Webstore	Point of sale + Online Ordering

Table 1: Similar App Comparison

2.5.2 Features Provided by existing systems

Name - Package	Features
Apptizer - \$119	<p>Responsive Mobile Web</p> <p>Pay with Credit Card</p> <p>Unlimited Orders</p> <p>Marketing Digi Pack</p> <p>Menu setup</p> <p>Delivery and shipping matrix</p> <p>Android app to manage orders</p> <p>Multilocation support</p>
App Institute	<p>Progressive Web App</p> <p>iPhone App</p> <p>Android App</p> <p>Push Notifications</p> <p>App Analytics</p>
Shoutem	<p>iPhone App</p> <p>Android App</p> <p>Html 5 App</p> <p>Push Notification</p>
Appy Pie	<p>Android App</p> <p>Html 5 App</p>

Table 2: Features provided by existing systems

2.5.3 Detailed Review on Remarkable Systems

2.5.3.1 Apptizer

Apptizer is one of the leading solutions for providing the businesses with an Online ordering system which is either an Order Ahead Application or Webstore. This is a really great approach as this platform allows the businesses to register in the Apptizer Website and once registered they can add their categories and products and generate the website and send a request for the development team to provide an android or iOS application.

Unfortunately, during the first few months of using a Website or Order Ahead Application a business may not see success using the application but with their current pricing plans the users have to pay for Apptizer even if the business does not get sales using their platform. As Apptizer use a database for their data storing the costs they incur for databases are reflected in the fees and other charges that are been charged.

Apptizer currently charges restaurants a \$500 setup fee and a \$139 monthly fee for the restaurant to keep on accessing their service, for small scale businesses \$500 setup fee is a little bit too much as they might not have that much of an income to invest in such a solution, so for a restaurant that wants to have a way to reach their customers and attract more customer while allowing them to order online a solution like Apptizer put the businesses at a disadvantage. And for a monthly cost of \$139 they only provide a simple webstore for the businesses, which only has the products of the business and a feature to order online, this does not provide people an insight on where the actual store is or any detail of the business.

2.5.3.2 App Institute

App institute is one of the leading app-building platforms, they provide a drag and drop builder platform that allows businesses to pick a template and edit the content accordingly and brand the application to be published. App Institute currently charges users \$95 monthly fee and provide a webstore, android application and an iOS application.

2.5.3.3 Uber Eats

Uber Eats is one of the most famous aggregate online ordering services that is popular in most of the countries among restaurants and guests. Uber Eats allow the restaurants to register the

business within their site and once registered the business is then added to a market place which is offered to the customers to choose from. Uber eats have had a 51% popularity among restaurants and a 26% popularity among guests according to a survey that was carried out by (Toast Inc., 2018)

According to (UberEATS, 2019) they charge a delivery fee of a certain amount depending on the distance from the ordering place to the restaurant, a service fee of 15%, and an additional charge if the order is below 10\$, and an additional service fee can be charged according to the restaurant taxes.

2.5.4 Aggregate Site Popularity

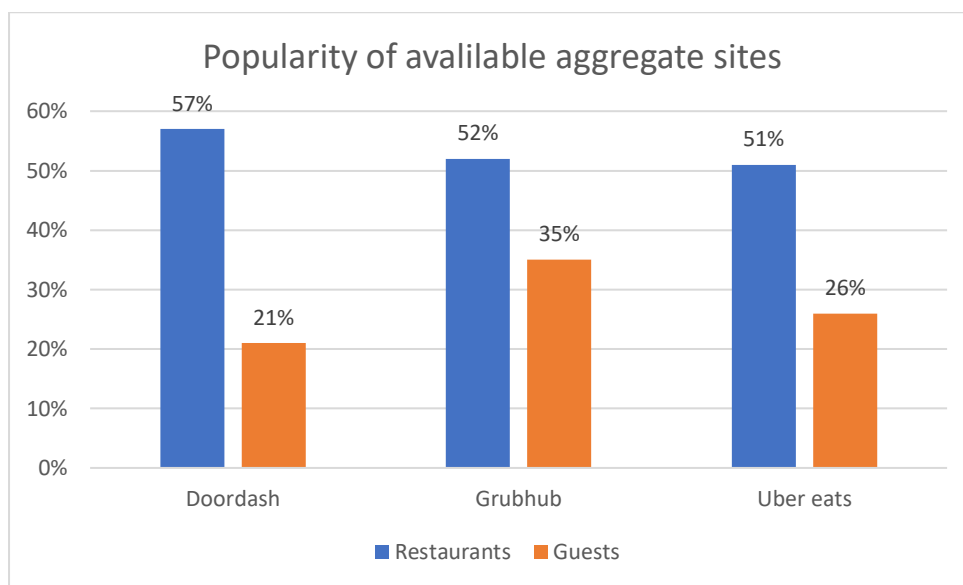


Figure 3: Aggregate Site Popularity

2.5.5 Drawbacks of existing platforms

A lot of order ahead application generation platforms have flourished over the year, but these platforms are plagued with high costs as commissions rating from 20% - 30% are been charged, or high monthly fees are charged disregarding the fact whether the business gained sales through the app.

As all the existing systems use a centralized structure to store the data the expenses are higher, and the rate of being hacked is higher which might lead to tampering of data of loss of data. Using blockchain it will be possible to overcome the above limitations.

2.6 Blockchain

Blockchain serves as an immutable distributed ledger which allows transactions to take place in a decentralized manner.(Zheng *et al.*, 2017). The ledger is spread across the peers in the network, while all peers hold a copy of the complete copy of the ledger.

As compared to traditional distributed databases, blockchain provides significant advantages over the traditional database systems. The advantages can be reduced cost and time, security. In the distributed system each node within the network holds a ledger and relies on some intermediary to perform transactions.

2.6.1 Why Blockchain?

The security of blockchain is higher and it provides tamper resistance as the block are required to be verified using consensus algorithms. The costs of using blockchain as a storage medium is relatively cheaper compared to the traditional databases. eBay which is a similar marketplace which allows users to sell their items was compared (Ranganthan *et al.*, 2018) statistics were compared to analyze the cost effectiveness of blockchain over databases, the tests were carried out in the Rinkeby test network, and this proved even with the gas fees to buy and sell a product is cheaper compared to existing systems like eBay. The cost of the blockchain depends on the consensus algorithms as each algorithm has a unique way of verifying the transactions, which allows blockchains to have a higher data integrity level.

2.6.2 Types of blockchain

Private	Public
Restricted a permissioned, joinable only by invitations.	Open to public.
Only allowed nodes can create new transactions.	Each node can create transactions.
Shorter transaction approval time/frequency.	Longer transaction approval time/frequency.
Higher speed on transaction completion.	Transactions take time to complete.
Relatively cheap transaction process cost.	Higher transaction process cost.
PoW, PoS consensus for verifying and adding blocks.	Pre-approved members accept blocks, PBFT (used by Hyperledger Fabric).
Higher energy consumption.	Lower energy consumption.

Table 3: Private vs Public Blockchain

2.6.3 Hyperledger Fabric

Hyperledger Fabric is a collaborative effort to create an enterprise grade, open source distributed ledger(Cachin, 2016). Hyperledger is a permissioned blockchain with immediate

finality, the transactions will be verified using the PBFT consensus mechanism. Hyperledger will be used in the project as Hyperledger fabric provides faster transaction speeds. HF also provides scalability as only a few number of nodes are responsible for the management of data, so the network is able to process and support more transactions.

2.7 Consensus mechanisms.

2.7.1 What is consensus.

Consensus is a fault tolerant mechanism which is used in blockchains to provide security which is achieved by a general agreement between the consumers, this provides a validation that only the valid and verified transactions are recorded. Consensus mechanisms empower the user in the blockchain to keep working even if some users come up short. Many consensus algorithms have been discussed in the literature pointing out the advantages and the disadvantages of each algorithm.

2.7.2 Consensus Approaches

2.7.2.1 PoW (Proof of Work)

PoW is a consensus mechanism that was used in the bitcoin network.(Satoshi Nakamoto, 2008).In PoW the crypto currency is dependent on energy consumption which introduces significant costs for the operations done in the network. Within a decentralized system someone has to be appointed to record the transaction within the network, the easiest way to achieve this is to do a random selection. However random selection is vulnerable to attacks. Here each node calculates the hash value of the block header, where the block header contains a nonce which is frequently updated by the miners. The miners are the nodes that compute the hashes, and the PoW procedure is called mining bitcoin.

2.7.2.2 PoS (Proof of Stake)

PoS is an energy saving alternative which is available to the PoS. Miners in PoS have to prove the ownership of the amount of currency. In comparison to PoW, PoS cost for mining is nearly as zero which makes it vulnerable for attacks as a consequence of it. According to (Zheng *et al.*, 2017)Many blockchains start with PoW and gradually move to PoS. In PoS the older or the richest. PPcoin uses a coin age based selection (King and Nadal, 2012) where the older and the larger have a higher probability of mining the next block.

2.7.2.3 PBFT (Practical Byzantine Fault Tolerance).

Hyperledger fabric utilizes PBFT as its consensus algorithm (Cachin, 2016) as this could handle up to 1/3 malicious byzantine replicas. A block is determined in round which in each round a primary will be selected according to a set of rules. For PBFT to work every node is required to be known by the network. PBFT is a replication algorithm which was introduced to tolerate byzantine faults.(Hao *et al.*, 2018). The energy consumption of PBFT is relatively low compared to PoS.

2.7.2.4 DPoS (Delegate Proof of Stake)

DPoS is a more efficient PoS mechanism which uses a real time voting and a reputation system to achieve consensus. Here the stakeholders elect their delegates to generate blocks and validate them. Since the validation is done using a fewer nodes, the confirmation of the blocks are relatively fast, therefore improving the time taken to confirm the transactions.

2.7.3 Consensus Algorithms Comparison.

	PoW	PoS	PBFT	DPoS
Management	Open	Open	Permissioned	Open
Energy Saving	No	Partial	Yes	Partial
Platform	Bitcoin	Peercoin	Hyperledger Fabric	Bitshares

Table 4: Consensus Algorithm Comparison

2.8 Scripting

Scripting is the process of automatic a set of tasks which have to been done repetitively by a user. Scripting can be of two types web-based scripting and system administration-based scripting. Shell scripting is the primary way for developers to interact with the operating system at a higher level. Shell scripts allow the developers to organize long and repetitive commands in a way that allows automation of various tasks. According to (Octoverse, no date) Shell is the 8th most popular language in 2019.

2.8.1 Scripting Languages

Scripting languages is a programming language that allows the developers to automate the executions of tasks. Scripts are mostly used within the run time environment to automate the execution of repetitive tasks. Scripting languages are interpreted from the source code or the byte code one command at a time rather than been compiled.

2.8.2 Scripting Languages Comparison

In this section a comparison of the scripting languages will be done stating the features, advantages, disadvantages and the popularity of each language.

Name	Features	Limitation	References
Python	Object Oriented Readable Syntaxes Extensible Extensive Library Support Rapid Development General Purpose Language Simple and easy to learn	Python is slower New comers may be put off by the python's indentation	
Ruby	Object Oriented Flexible Syntaxes	Slower compared to the other languages	

	Extensible Rich Set of Libraries Simple and easy to learn		
JavaScript	Speed Simple and easy to learn	Best Suited for web-based application Different engines render JavaScript differently	
PHP	Object Oriented Open Source Procedural	Best Suited for web-based application	(Sebastian, 2010)
Scala	Seamless integration with java Object Oriented Extensible	Limited developer pool	(TEAM, 2018)

Table 5: Scripting language comparison

2.8.3 Python

Python which was introduced in 1991, by Guido van Rossum (W3schools, no date), is a general purpose dynamic programming language (Millman and Aivazis, 2011), which has gained popularity within the scientific computing community due to its simplicity of syntaxes, extended standard libraries, and a matured eco-system for of high quality third-party packages that are available for almost all tasks including ML and Scientific Computing. The language was influenced by ABC, ALGOL 68, C, Haskell, Lisp, Modula-3, Perl, and Java while influencing the design of other languages namely: Boo, Cobra, D, Falcon, Groovy, Ruby, and JavaScript. (Oluwagbemi *et al.*, 2013). Python which has been existent for over 21years are used by prominent tech companies like Google, Yahoo, NASA. Python will be used in the proposed solution as python provides simplicity in syntaxes and a wide variety of third party packages.

2.9 Reflection

With the service charges that are been charged by services like UberEATS, and the pricing of Order Ahead Application providers like Applova restaurants are put at a disadvantage as the cost are higher to keep the services going. The proposed solution for this is to use a blockchain based platform where the data is stored in the blockchain, according to (Ranganthan *et al.*, 2018) testing that was conducted, it shows that blockchain is one of the most suitable solutions to overcome the fees and the monthly charges. As not much solutions are available for the Order Ahead Application generation a platform using blockchain will be able to help many restaurants to get their own Order Ahead Application. Blockchain also provides data security and integrity. With the use of python, the test build will be automated which will allow the users to test the application before purchasing the application, a React Native application will be provided to the user and the android version of the application will be provided for testing purposes.

2.10 Chapter summary

Shortage of low cost order ahead application providers have restaurants to face many problems as it reduces the customer base who order via mobile. Online ordering has been discussed in details and the systems that allow online ordering have been discussed and the details of the online ordering consumers and trends of online ordering have been discussed, and the importance of the online ordering have been discussed

Furthermore, the current systems that provide generation of online ordering systems have been reviewed and the cost, service provided, type have been identified and shown, also the features that are provided by each system have been pointed out. A more detailed review have been done about the most remarkable systems.

Furthermore, with the identification that the current online ordering systems are costly and other drawbacks like = data safety, integrity and low costs blockchain have been discussed in detail. A comparison was done between the private and public blockchains. A detailed review of the blockchain technology that will be used in the product have been discussed. The consensus algorithms have been discussed in detail and a comparison was done among the discussed consensus algorithms.

Moreover, this chapter reviews the languages that can be used for automation of APK generation, out of all the available languages the languages that support scripting have been

supported and a comparison of the languages have been carried out. Python which will be the language that will be used have been identified and have been discussed in detail.

In conclusion with all the knowledge available about, online ordering, blockchain and scripting languages, order ahead application generation can be carried out with blockchain whereas the building and automation could be achieved via python.

References

- Cachin, C. (2016) 'Architecture of the Hyperledger Blockchain Fabric', *Workshop on Distributed Cryptocurrencies and Consensus Ledgers (DCCL 2016)*, URL:, p. https://www.zurich.ibm.com/dccl/papers/cachin_dccl. Available at: <http://bytacoin.io/main/Hyperledger.pdf>.
- CardinalCommerce (no date) *No Title*. Available at: <https://payments.cardinalcommerce.com/online-spending-habits> (Accessed: 2 November 2019).
- Hao, X. *et al.* (2018) 'Dynamic practical byzantine fault tolerance', *2018 IEEE Conference on Communications and Network Security, CNS 2018*, (February), pp. 1–14. doi: 10.1109/CNS.2018.8433150.
- HONG, L. W. (2016) 'Food Ordering System Using Mobile Phone', 147, pp. 11–40.
- King, S. and Nadal, S. (2012) 'PPCoin : Peer-to-Peer Crypto-Currency with Proof-of-Stake'.
- Millman, K. J. and Aivazis, M. (2011) 'Python for scientists and engineers', *Computing in Science and Engineering*, 13(2), pp. 9–12. doi: 10.1109/MCSE.2011.36.
- Octoverse (no date) *No Title*. Available at: <https://octoverse.github.com> (Accessed: 2 October 2019).
- Oluwagbemi, O. *et al.* (2013) 'An analysis of scripting languages for research in applied computing', *Proceedings - 16th IEEE International Conference on Computational Science and Engineering, CSE 2013*, (December), pp. 1174–1180. doi: 10.1109/CSE.2013.174.
- Pantelidis, I. S. (2009) 'High tech foodservice; an overview of technological advancements.', *CHME 18th Annual Research Conference*, (September).
- Ranganthan, V. P. *et al.* (2018) 'A decentralized marketplace application on the ethereum blockchain', *Proceedings - 4th IEEE International Conference on Collaboration and Internet Computing, CIC 2018*, pp. 90–97. doi: 10.1109/CIC.2018.00023.
- Satoshi Nakamoto (2008) 'Bitcoin: A Peer-to-Peer Electronic Cash System', *Journal for General Philosophy of Science*, 39(1), pp. 53–67. doi: 10.1007/s10838-008-9062-0.
- Sebastian, N. J. (2010) 'Comparative study of the Pros and Cons of Programming languages Java , Scala , C ++ , Haskell , VB . NET , AspectJ , Perl , Ruby & Scheme', *arXiv preprint arXiv:1008.3431*.
- TEAM, D. (2018) *Pros and Cons of Scala*. Available at: [14](https://data-</p></div><div data-bbox=)

flair.training/blogs/scala-advantages/ (Accessed: 2 October 2019).

Toast Inc. (2018) 'Restaurant Success in 2018', pp. 1–27. Available at:

[https://pos.toasttab.com/hubfs/Content_+_Assets/2018 Restaurant Success Industry Report.pdf?hsCtaTracking=6c15aab7-e35d-4daa-a84b-a5303191078b%7C1339e588-3f3b-4dc4-8339-265c298c09ce](https://pos.toasttab.com/hubfs/Content_+_Assets/2018%20Restaurant%20Success%20Industry%20Report.pdf?hsCtaTracking=6c15aab7-e35d-4daa-a84b-a5303191078b%7C1339e588-3f3b-4dc4-8339-265c298c09ce).

UberEATS (2019) *How do fees work on Uber Eats?*

W3schools (no date) *No Title*.

Zheng, Z. *et al.* (2017) 'An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends', *Proceedings - 2017 IEEE 6th International Congress on Big Data, BigData Congress 2017*, pp. 557–564. doi: 10.1109/BigDataCongress.2017.85.