Ozone: A Decentralized Travel Distribution Network

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Abstract

Travel booking is a multibillion-dollar industry currently controlled by three players — Amadeus, Sabre, and Travelport — that operate within an effective oligopoly. This setup not only removes transparency but also induces exorbitant costs to end users and slows down innovation. We propose a solution to these inefficiencies based on distributed ledger (blockchain) technology. Existing systems can be replaced by a decentralized network that provides useful services for a predefined reward, without the need for central management or trusted third parties. The network itself is self-sufficient and requires minimal structure, the nodes can leave and rejoin the network at will. With this, we transform travel inventory distribution into an algorithmic market — open, secure and transparent for all participants.

Note: Ozone whitepaper is a work in progress and an evolving document. The purpose of this document is to describe high-level protocol implementation using blockchain technology. It is intended for informational purposes only, does not and will not create any legally binding obligation on the authors or on any third party.

Active research is underway, and new versions of this paper will appear at *https://ozone-platform.com*. For questions, comments, or suggestions, please reach us at *info@ozone-platform.com*.

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Problem Statement

The travel and tourism industry is among the largest and fastest growing industries worldwide. In 2016 travel and tourism contributed USD2.3 trillion to the global economy. This is largely driven by an increase in people mobility and the greater accessibility of travel — resulting in four billion travel bookings in 2016 alone. For the sixth year in a row, travel & tourism outpaced the growth of the global economy as a whole: 3.1% versus 2.5% in 2016. This trend is expected to continue in the future, making it an attractive segment to enter. [1]

One and a half billion of those four billion bookings are distributed through travel inventory distribution engines. This segment of the market is entirely dominated by three distributors — Amadeus, Sabre, and Travelport — that control 96% of the market and compete in an effective oligopoly. [1] Distributors have a critical role in the ecosystem as they connect suppliers on one end (airlines, hotels, car rentals, etc.) with buyers (end-consumers, travel agencies, online travel agencies, metasearch engines, etc.) on the other end of the travel value chain. The complexity of the distributors' role arises from the need to enable constant and simultaneous inventory trading between suppliers and buyers. This unique position makes distribution the backbone of the entire travel booking market. Finally, the favorable structure of the market and the relevance of their business per se leaves the three behemoths with little incentive to innovate.

Consequently, travel booking today is expensive, complex, unreliable, and non-transparent. Firstly, systems are not only costly to run, but distributors also have the power to charge unreasonably high fees. As a result, booking takes up to 4% of airline revenue in fees and adds great weight to the disbalance of the returns across the value chain. Secondly, existing global distribution systems are obsolete — they are limited to offering plain vanilla tickets and cannot support a wide variety of products and services travel suppliers have to offer (such as additional luggage, extra legroom or a special meal). Some upgrading efforts exist (such as NDC or OpenTravel initiatives) but are very slow in implementation. Also, the user interface is outdated and resembles command prompt line with codes for every action so that travel agents typically need a month of training (at least) to master. Further, the industry is concentrated and systems run on centralized servers susceptible to failures and downtime. Subsequently, breakdowns of those systems have catastrophic repercussions for the industry globally and time and again leave passengers stranded at airports across the world. Finally, due to the industry structure, distribution is non-transparent. This creates many problems for the end-customer ranging from overbooking to costly cancellations to an inability to transfer or resell a ticket.

Ozone Ecosystem

Ozone is a travel booking protocol set to disrupt the monopolistic legacy inventory distributors surrounding inventory providers. It is based on distributed blockchain technology and features the most comprehensive inventory of airlines, hotels, and car rentals.

In standard internet layer terminology, the Ozone Ecosystem outlines a set of interworking methods, protocols, and specifications organized around two core layers: *protocol layer* and *application layer*.

Ozone protocol layer introduces an open-source protocol that connects travel buyers and suppliers directly over a distributed blockchain ledger and eliminates all middle layers making them redundant. The end-to-end protocol covers the entire travel booking value chain, governing (1) posting inventory on the system, (2) distribution, (3) booking, and (4) settlement. Each step is executed independently, without the need for a trusted third party: suppliers distribute their inventory in a trustless manner over a decentralized network; buyers query inventory and book and pay for their preferred choice without third-party involvement.

Ozone protocol describes three roles integral to the system: buyer, distributor, and supplier, and defines four smart contracts encompassing and governing the whole travel booking value chain:

- Inventory representation through non-fungible[1] ERC721 Ozone Contract;
- Booking, payment, and settlement through Booking Contract;
- Transactions and incentive structure through ERC20 Oxygen Contract;
- Digital identity of all actors in the system through ERC725 Digital Identity Contract.

It brings many benefits to the travel booking industry, among others:

- Cheaper fees for end consumers reducing booking costs up to ten times;
- Enhanced placement for airlines introducing a simpler and more flexible solution that supports a breadth of value-add products and services and is affordable even for low-cost carriers;
- Open and transparent booking that eradicates overbooking and enables new business models — such as a secondary market for tickets;
- Security and reliability protecting data from deletion, tampering, and revision.

Protocol layer is decoupled from the application layer and is application-agnostic. The code that powers the network and implements core functionality is open-source and owned by the community. It defines a standard on top of which various applications can be deployed

[1] In economics, fungibility is the property of a good or a commodity whose individual units are essentially interchangeable.

and as such allows anyone to contribute and implement upgrades beneficial for the entire network.

The application layer, on the other end, defines an additional set of non-essential but useful applications and specifications all or some of which might not be open-source. Just as — in world-wide-web terminology — mobile apps bring value add for the end-customer on top of the TCP/IP protocol layers, so will the Ozone application layer build various value-added applications on top of the core Ozone protocol. Such applications might be a (buyer) user interface or supplier API or a payment system with integrated exchange for various fiat and crypto currencies — to name a few. Ozone, too, will invest in building the application layer on top of the open-source protocol to further enhance and complement the entire Ozone ecosystem.

Ozone Protocol Layer

Ozone at the protocol layer is open-source and application-agnostic. It lays out how different actors participate in the travel distribution value chain in a trustless and economically rational way. The protocol layer is made up of two integral parts:

- Off-chain distribution network
- Trustless exchange protocol

In a nutshell, inventory distribution through Ozone can be described as *off-chain order distribution* and *on-chain settlement*.

Cryptographically signed orders are broadcast off of the blockchain on decentralized exchanges. Orders are data messages that describe inventory availability and pricing and are cryptographically signed by a supplier private key to verify ownership. As frequent price changes are inherent to the travel industry, relaying orders off-chain allows their dynamic and algorithmic management.

Next, an on-chain exchange allows for the trading of uniquely identifiable tokens associated with those orders in a trustless manner. Inventory ownership is represented and managed through a smart contract. The interested counterparty (buyer) can inject one or more of those orders into a smart contract to execute the trade trustlessly, directly on the blockchain.

In this way, Ozone combines the best of both worlds: the efficiency of state channels on one hand, with near instant on-chain settlement of off-chain order books[2] on the other. It minimizes transaction costs and avoids blockchain bloat as market makers can signal their intent off-chain and the transaction only occurs when the value is being transferred. Further, there is no single point of failure, the transactions are censorship resistant and publicly verifiable.

Finally, when it comes to core functionality, Ozone protocol is designed to:

- Allow suppliers to publish inventory on-chain and distribute orders (including availability and pricing) off-chain;
- Allow distributors to contribute their processing power and bandwidth to relay orders in exchange for a fee;
- Allow buyers to execute trades trustlessly, over a public blockchain.

The distinct roles, core functionality, architecture, design specifics, and smart contracts integral to the protocol are described in the following chapters.

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[2] An order book is used to publicly record the interest of buyers and sellers in a particular asset. Each entry includes a reference to the interested party, the underlying asset, and the price that the buyer or seller bid/ask for it.

Roles

Suppliers are the providers of inventory on the Ozone network. Any individual or organization that owns and is eligible to sell travel inventory can act as a supplier: airline, hotel, car rental company, any other organization or individual in possession of an airline ticket, hotel booking or car rental at the moment of transaction. Suppliers can sell their inventory directly to the buyer or they can use the off-chain distribution network for a fee.

Distributors form the off-chain distribution network. They facilitate trades between suppliers and buyers by maintaining a book of orders originating from different suppliers thus creating liquidity. The protocol itself is agnostic to the medium of exchange — it allows anyone to act as an exchange thereby liberalizing the market. In fact, it allows direct *point-to-point* order exchange between any two actors (supplier and buyer) thus effectively eliminating the need for a distributor at all. Nonetheless, to solve the *introduction challenge* — i.e. matching buyers with suppliers that own specific inventory — Ozone will implement order broadcasting mechanism or, in other words, the first distributor. Distributors are incentivized for their participation in the distribution network through a fee charged at the event of booking.

Buyers are the purchasers of inventory on the Ozone network. Any individual or organization looking to buy inventory and in the possession of sufficient funds can act as a buyer: traveler, tourist agency, corporate travel agency, etc. Buyers can buy the inventory peer-to-peer directly from a specific supplier or they can use the off-chain distribution network for a fee.

The aforementioned actors interact in a trustless manner and form a global travel inventory distribution value chain.

Functionality

The Ozone protocol follows a general sequence of four logical steps used for off-chain order distribution and on-chain settlement. Those four steps cover the travel distribution value chain end-to-end and are as follows: (1) Publishing (2) Distribution (3) Booking and (4) Settlement. Ozone will seek to provide a decentralized solution for each of those four steps so that all can be executed transparently, securely, and without third party involvement.

1. Publishing

The supplier mints a non-fungible Ozone token (OZN) representing their inventory (aircraft, hotel, car) on-chain. Once they are ready to sell, the supplier creates an order to exchange the Ozone token for some other fungible token, specifying a desired price (or pricing logic if price is due to be changed under certain conditions), expiration time (*time-to-leave* — TTL — beyond which an order cannot be filled), and signs the order with their

private key. The supplier then broadcasts the order off-chain, over any arbitrary communication medium — typically to one or more distributors of their choice.

2. Distribution

Anyone can act as an off-chain exchange, maintaining an order book (whether public or private) and charging fees on all resulting transactions. These entities facilitate signaling between suppliers and buyers by hosting and transmitting the order book made up of standardized messages. They connect the supplier with prospective buyers but do not execute trades on behalf of them to preserve a trustless environment. Distributors typically act as such mediums of exchange. Also, a well-designed application can approximate a typical type of user experience implementing personalized search, filtering, and a bundling functionality.

3. Booking

Distributors only recommend the best option or a list of options (unless the transaction is *point-to-point*), while the buyer independently decides to sign the transaction and send it to the blockchain. When a buyer finds the preferred order — either directly with the supplier or through the distribution network — they proceed with a booking. The buyer fills the supplier's order by submitting it to the booking contract on blockchain. As each order is signed with the supplier's private key, the booking contract is able to authenticate the order originator by returning their public key and comparing it to the supplier's address. Once the supplier has been authenticated, the booking contract executes booking and payment. If the distributor has referred the buyer to the supplier — at the successful completion of a transaction — they are rewarded with a fee attached to the order.

4. Settlement

Settlement — the distribution of value between different actors — is somewhat unique to the travel industry. In travel, partnership agreements are common and funds received as a payment at the event of booking are sometimes split between different actors. Some of the examples for this are bundled offers (involving, for instance, a hotel room and a flight) or *codeshare*[3] flights. Settlement is the responsibility of a supplier. A booking contract can point to an arbitrary smart contract — the supplier has the option to transfer the funds to his own account and manually compensate each of the subcontractors or to automate the process using a settlement smart contract. Should they opt for the latter, the settlement contract receives and splits the funds for them according to the predefined logic.

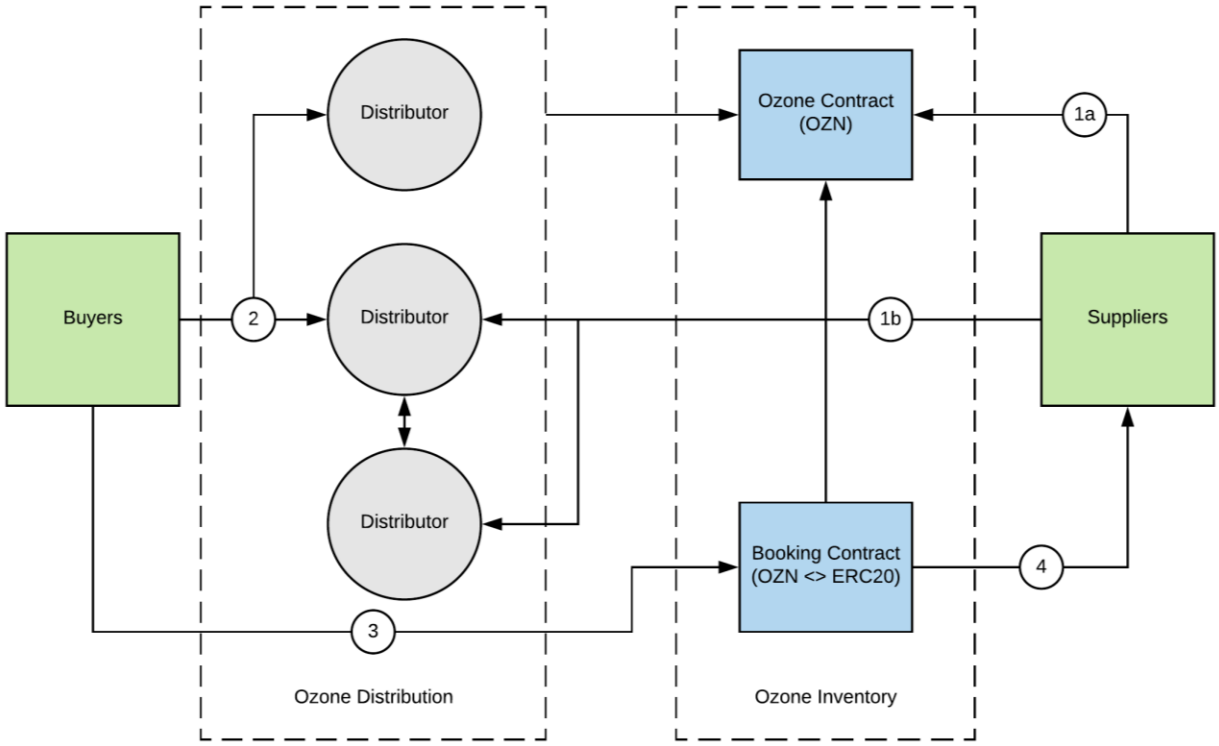

Figure 1: Off-chain distribution network and trustless exchange protocol distribute inventory according to a general sequence of four logical steps: (1) Publishing (2) Distribution (3) Booking and (4) Settlement. (1a) The supplier mints non-fungible tokens representing their inventory on-chain. (1b) The supplier then creates an order specifying price and expiration time, signs the order with their private key and broadcasts the order off-chain, over an arbitrary communication medium, typically a distributor. (2) The distributors host and transmit the order book made up of standardized messages thus facilitating the signalling between suppliers and buyers. (3) When a buyer finds a suitable order, they fill the order by submitting it the the booking contract on blockchain. The booking contract authenticates the supplier and executes booking and payment. (4) Finally, the settlement contract (optional) receives and splits the payment to different stakeholders according to a predefined logic.

Architecture

At present, Ozone leverages Ethereum blockchain as the backbone to run its smart contracts. Should a better solution emerge in the future, Ozone is open to exploring the option of transitioning to another blockchain.

Just as the Ozone Protocol Layer itself, the architecture is logically segmented into two integral parts: *off-chain distribution network* — a distributed exchange of tokenized assets — and *trustless exchange protocol* — a set of smart contracts governing the trustless exchange of inventory. Both are detailed in the following.

1. (Off-chain) Distribution Network

Frequently modifying order prices in response to market conditions amounts to a major cost despite the small cost of a single on-chain transaction. To prevent this, orders are updated and transported off-chain, massively reducing gas costs and eliminating blockchain bloat.

While a centralized exchange must build and operate proprietary infrastructure, execute trades and handle user funds, distributors merely facilitate signaling between market participants by hosting and propagating market orders. Distributors help broadcast orders and collect a fee each time they facilitate a trade. Distributors do not execute trades on behalf of market participants as this would require market participants to place trust in a third party. Instead, consumers execute their own trades.

Ozone will build the first distributor to facilitate inventory trading. This however is non-exclusive — other third-party distributors can be built to provide liquid markets specific travel industry domains.

Suppliers create a cryptographically signed order and send it to the distributors, who are responsible for its verification. They are incentivized to verify that the orders they broadcast, have enough Oxygen tokens on their maker's accounts to successfully execute. Similarly, once a taker chooses to fill an order, he needs to provide enough Oxygen tokens to pay the takers fee to execute it. To successfully execute as many orders possible, distributors are incentivized to remove stale and unfulfillable orders.

As a part of the Ozone protocol, distributors can publish their Distributor Profile. The profile describes the types of inventory that can be found on their system which not only allows for distribution specialization and differentiation (e.g., high-end travelers or European regional flights) but also keeps the system scalable. Distributors need to be able to communicate their portfolio to buyers, or they would face an issue of scalability, receiving too many requests, with a limited amount of relevant ones. At the same time, buyers would suffer from a high level of inefficiency, for instance, low or slow response rates. If buyers had to send requests to all distributors without some control mechanism in place, most of the messages would be irrelevant — the distributor receiving the requests would not necessarily have offers that meet the criteria. To find an appropriate order, buyer must first determine which distributors are offering such inventory. To make this determination, he may query a subset of all distributors that match the specific profile.

The use of the public Distributor Profile Registry is not mandatory. There is an option for specific distributors to make (private) direct agreements with their partners. This, in turn, creates a highly specialized, luxury or private markets.

While the distributors may act as front-end sale channels, Ozone protocol also supports an additional layer of actors in the protocol. In the current travel system, competitiveness is achieved by offering larger inventory pool than your competitors. Businesses that wish to create sales channels with simple but powerful user experiences for customers, that offer large inventory pools by searching and querying many distributors, and create personalized offers based on their knowledge of the customer will be able to collect referral fees on the orders filled by those buyers.

2. Trustless Exchange Protocol

2.1. ERC20 Oxygen Contract

Oxygen is implemented according to the Ethereum token standard (ERC20) interface. The standard interface provides basic functionality to transfer tokens. It also allows tokens to be approved so they can be spent by another on-chain third party or contract. This functionality allows the interaction between Oxygen and booking or other Ozone contracts.

2.2. Booking Contract

The Booking contracts defines the rules to execute bookings of Ozone orders. It checks if the order is valid by validating the Ozone supplier ownership, expiration period, and signatures. Once these are all validated, the contract executes the transaction by transferring the ownership and accrediting the token to buyer's wallet.

The contract is also programmed to settle accounts between buyers, suppliers, and distributors. It charges the cost of the ticket, *maker* and *taker fee,* and potentially referral fee. No other costs besides those are imposed on either buyer or supplier by the contract itself. The contract then credits the cost of the ticket to the supplier and transfers appropriate fees to distributor and point-of-sale (POS). Additionally, supplier can set the receiving address to point either to a wallet or a contract that can in turn handle advanced settlement cases.

The initial version of the contract supports an exchange of Ozone tokens for any `ERC20` token. Ozone will seek to improve the contract to support additional payment options using other cryptocurrencies.

2.3. ERC721 Ozone Contract and Distributed File System

Travel inventory is represented by non-fungible, transferable digital token stored in an Ethereum smart contract that corresponds to a single travel inventory item owned by a specific user or entity. The token can represent an airline ticket, hotel reservation, car rental agreement or anything similar. Once a user has acquired the token, he alone is the owner, within the contractual rights published on the blockchain.

For the consumer to trust the system, he needs a strong guarantee that purchased token cannot change at a later time. Token description or metadata is stored in an immutable

document linked by the Ozone Contract. This document contains all the metadata necessary to describe the specific ticket, voucher or coupon. Suppliers can also add photos, videos and other media files that describe the token. Additionally, any attestations, certificates or other proofs of service can be provided.

Token metadata can be stored almost anywhere where it can be accessed through HTTP(S) protocol, but the preferred storage method is using a peer-to-peer file system protocol like IPFS [8][9] or Swarm[3] due to their scalability, persistence, and immutability. These protocols provide robust systems built on blockchain technology. The reference and data never change, unlike standard web links that frequently change when a file is moved, or server location is updated.

2.4. ERC725 Identity

The Ozone Protocol allows actors in the system to participate in the exchange in a trustless manner, without the need for a trusted third-party to resolve conflicts. However, this trust is difficult to translate to the real world. For instance, the buyer on the system can book a flight with its ticket being immutably stored on blockchain only to find out — when they want to utilize it — that the flight has been cancelled or that the airline operator is non-existent. To extend counterparty trust beyond the exchange protocol and into the real world, Ozone leverages digital identity and reputation mechanisms. Such mechanisms help distinguish between trustworthy and fraudulent agents.

Digital identity can be associated with both buyers and suppliers. The user controls their private information through a private key. They can choose to share private information easily and securely with travel agents, such as their full name, photo id, travel documents, or other. In turn this will allow us to improve the way travelers are identified during their journey and unlock a host of new application modes. For instance, travel agents can then provide a tailored range of services based on user's preferences. At the airport, this technology could be used to help with booking, check-in, baggage tracking, and security. On the other hand, suppliers can tie any attestations, certificates or other proofs of service that they currently have to their digital identity. This can help to increase trust that the service represented by the token will be of advertised quality.

As this is not its core business, Ozone Protocol will leverage third-party solutions that implement this functionality. Several commendable projects are already researching this area such as uPort[4], Civic[5], or ShoCard[6].

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[3] **Swarm**, similarly to IPFS, is a distributed storage platform and content distribution service, a native base layer service of the ethereum web3 stack.

[4] A self-sovereign identity and user-centric data platform enabled and secured by Ethereum. To use the **uPort** service one does not need a dedicated ERC20 token [10].

[5] **Civic** is building an ecosystem that is designed to facilitate on-demand secure and low-cost access to identity verification services via the blockchain. Participants use the Civic token (CVC) to transact in identity verification related services.

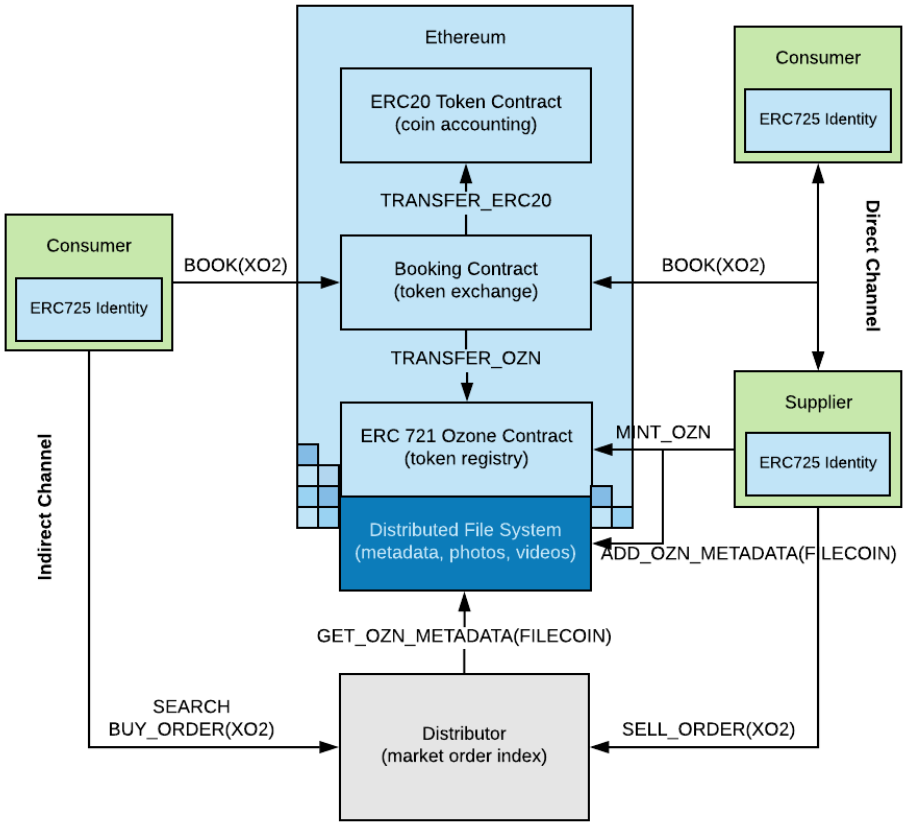

Figure 2: Ozone connects travel buyers and suppliers directly over a distributed blockchain ledger. Ozone (ERC721), Oxygen (ERC20), Booking, and Digital Identity (ERC725) contracts govern the trustless exchange of inventory and are implemented as smart contracts on Ethereum blockchain. Distributors are powerful off-chain exchanges competing for supplier and buyer traffic in distributed exchange of tokenized assets.

Smart Contracts and Tokens

1. Ozone Token [OZN: `ERC721`]

Ozone token is implemented on top of the upcoming Ethereum ERC: Non-fungible Token Standard (`ERC721`), the proposed standard for transactions and ownership of non-fungible assets on the blockchain. A good example is Decentraland's LAND token [4], one of the first implementations of the Ethereum based non-fungible token. Recently the Decentralands team updated the LAND contract interface to follow the `ERC721` standard, which was in

[6] **ShoCard** is a mobile-identity platform, powered by blockchain technology, using biometrics that enterprises can adopt for definitive authentication while protecting their users privacy. They are collaborating with **SITA**, the world's leading specialist in air transport communications and information technology, to provide a unified identification experience for a traveler across multiple airports traveling on numerous airlines, across different countries.

fact pioneered by the team behind another popular Ethereum project — CryptoKitties[7]. We trust these, and other efforts will result in a standard Ethereum non-fungible token interface.

This non-fungible token would have an `ERC20` compatible interface to minimize the effort required for wallets (in particular) to track non-fungible tokens while echoing a well-understood standard. While we follow the semantics of `ERC20` as closely as possible, it is impossible to be entirely compatible with it due to the fundamental differences between fungible and non-fungible tokens. The non-fungible token interface adds essential ownership transfer functions, matching between an owner and token id, and metadata.

Ozone wallet

Ozone will develop a wallet application that enables the user to view and manage their Ozone tokens. We trust other Ethereum's wallet applications will also add support for `ERC721` non-fungible tokens as the standard gets accepted by the community. The wallet will support the following functionality:

- Display the list of all tokens owned by the user, with detailed information,
- Receive notifications about token updates,
- Detailed info such as links, phone numbers, email addresses for connecting with supplier's customer support,
- Identity verification and management with third-party integrations,
- Management of users pseudo-anonymous identities used as privacy protection on the public Ethereum blockchain.

The user can check-in into a hotel or a flight by displaying their token to the authorized person or application. The wallet will support interoperable standards defined by Ethereum community, where applicable.

2. Oxygen Token [XO2: `ERC20`]

The Oxygen Token is the `ERC20` protocol token that fuels the incentive layer of the Ozone Distribution network. Using a dedicated token to facilitate protocol transactions provides several advantages over the use of existing tokens, including:

- Provides stability and shields the network from extraneous influences that can make other cryptocurrencies volatile. The token should not depend on broader blockchain economics but rather on travel booking specific use case and demand/supply profile.
- Provides a way to manage Ozone network incentives. Allows for a protocol currency to be designed as inflationary in a way that is appropriate for the specific travel

[7] CryptoKitties is a game developed by Axiom Zen team, centered around breedable, collectible, and oh-so-adorable digital cats.

industry use case. Protocol encourages network participation by autonomously distributing interests and other benefits to token holders.

- Enables Ozone to change token's utility and implementation. For instance, underlying blockchain technology could be changed in the future if some other implementation proves more suitable.
- Enables a decentralized governance system, one featuring budgets, proposals, and voting. The network elects proposals which would increase its capability and value and which should, in turn, increase tokens utility.

3. Digital Identity Token [ERC725]

Public/private key cryptography and decentralized blockchain technologies enable us to improve the way actors are identified during their participation in the Ozone protocol. These technologies push ownership of identity away from centralized services, to the edges, to individuals so that the identities themselves are in control. This is commonly referred to as self-sovereign identity. The blockchain can be viewed as a decentralized certificate authority that can maintain the mapping of identities to public keys. An identity can be cryptographically linked to off-chain data stores where different claims, proofs, and attestations can be stored. The data is controlled by the user with a private key. Ozone protocol will use identity technology rooted in Ethereum blockchain — i.e., an accepted standard like the ERC725 token to verify user identity by checking issued claims about that identity (ERC735) at specific points (e.g., booking, order updates, cancellation, etc.).

While digital identity is necessary to make sure that the right person consumes the ticket, it is critical that a malicious attacker cannot access any private information about a customer or their travels. Instead of allowing everyone to link together someone's searches into a public search history, users can create multiple personas (also called pseudonyms) on the blockchain. The user can choose to reuse a pseudonym for bookings that are related to each other, or use a different pseudonym for every booking. We enable this by building a strong cryptographic commitment that binds each pseudonym to a real identity in a verified way. When the user needs to prove that he controls both his pseudonym and real identity to another party, a simple solution is to just sign a random data with both keys, and the other party can validate both signatures using users' respective public keys. This technique enables travelers to protect their privacy online, while at the same time allows suppliers to know their customers and build rich profiles to optimize their distribution channels further.

Design Specifics

1. Fee System

Ozone Protocol defines how different roles in the system — suppliers, distributors, and buyers — transact in an economically rational way by setting up a fee system.

If we compare Ozone Protocol to traditional exchanges, suppliers play the role of *market makers*, i.e., users that expand the market by creating new orders and publishing those with the distributors. On the other hand, buyers act as *market takers*, i.e., users who reduce the market size by filling those orders.

The protocol defines two sets of fees: *maker-taker fee* representing a compensation for the distributor, and *referral fee* representing a compensation for the point of sale business (POS).

Fees are only charged when the transaction occurs or in other words at the event of booking (when the order is filled). At that point, fees flow from suppliers and buyers (entities paying for the service) to distributors (entities delivering the service). All other actions on the system are free off protocol imposed fees.

Each distributor has an option to declare the minimal price of their services by setting a minimal *maker fee* and *taker fee*. If the order does not provide the required fees — maker or taker fee or both — distributor can reject to list it.

Further, the protocol also enables the suppliers to include an optional referral fee. The referral fee serves as an incentive for businesses to invest into building customer centric applications to augment the basic protocol. These applications should aim to provide better reach and customer conversion by providing additional services such as an easy-to-use user interface or personalization of search results, etc. In essence, protocol automatically rewards POS businesses for a realized sale through a referral fee. The supplier can set up different referral fees for different resellers.

2. Oxygen Inflationary Supply

Many cryptocurrencies that provide utility besides store of value are inflationary in nature. In contrast to Bitcoin, that has a hard cap of 21 million, Ethereum was created with the idea that there should not be a maximum limit on the number of tokens. Like Ethereum's Ether, Ozone's Oxygen token is created as a fuel that powers the network, and is inflationary in nature.

Inflation motivates users to participate in the network as opposed to simply holding their tokens. This in turn results in a system that is more resistant to speculation and token price volatility. It also gives confidence to suppliers, travel agencies, and other industry actors to join a growing and stable network.

No new tokens are minted before the Ozone network is fully operational. At launch, token issuance will continue according to the pre-defined inflationary schedule that will follow supply-demand dynamics. Inflation schedule will dictate the distribution rate of the newly minted tokens.

Most of the newly minted tokens are allocated to users who actively participate in the network and stake their tokens against their behavior as reputation. In specific, tokens minted according to the inflationary schedule are distributed in the following manner:

- 90% are allocated to the users who have bonded their stake, pro-rata based on the bonded stake and contribution levels;
- 10% allocated to the Ozone Innovate Fund.

After each executed transaction, the contribution levels of each participating party (buyers, distributors or suppliers) is increased relative to their current contribution level, contribution levels of other participating parties, and the weight of the fees included in the transaction.

- Buyers contribution level is increased based on their reputation and suppliers' reputation for tokens they purchased
- Suppliers contribution level is increased based on their reputation and buyers' reputation to whom they sold their tokens
- Distributors contribution level is increased based on total stake of all participants in processed orders

If actors frequently trade with the same counterparties, their contribution level increases will diminish with each trade.

Individual shares are calculated once all contributions within single inflation window are accounted for. Share is calculated as a function of current stake size and individual transaction contributions.

A certain percentage of tokens minted through inflation is used to support the Ozone Innovate Fund. The Ozone Innovate Fund is a vehicle intended to accelerate the implementation of Ozone network improvement proposals by the developers' community. It is set up to incentivize and allow developers community to evolve and expand the protocol into a wider ecosystem of tools and integrations.

3. Counterparty Trust

To increase the trust within the system — complementary to digital identity — we propose a simple reputation mechanism based on network participation and stake. If participating parties act in a way that would harm the network, like propagating stale orders, frequently cancel orders that have been recently sold or similar, their reputation, as represented by their bonded tokens, is cut. Ozone protocol will focus on developing slashing conditions that incentivize good behavior of participants consuming the protocol.

In example, stake slashing mechanism can discourage malicious actors that would try and adapt multiple different identities to continue acting in a fraudulent way. If such actions have monetary costs, such behavior might be deterred.

All parties participating in the protocol can bond a certain number of tokens to their address for the duration of the bonding period[8]. Bonded stakes of each participating party (buyers, distributors or suppliers) can be increased or decreased based on his behavior.

Actors reputation is increased relative to their current reputation, their contribution level and contribution levels of other parties participating in their transactions during the single inflation window. The increase occurs at the end of every inflation window.

- Consumers contribution level is increased based on their reputation and suppliers' reputation from whom they purchased the Ozone tokens;
- Suppliers reputation is increased based on their reputation and consumers' reputation to whom they sold their Ozone tokens;
- Distributors contribution level is increased based on total reputation of all participants in executed orders.

Ozone will also seek to provide space for services to emerge that would serve as conflict resolution arbitraries, escrow services, insurance agents and other, that can tie into Ozone reputation mechanism.

Ozone Consensus Algorithm

Ozone has a three-part consensus scheme where each part if associated with a different subset of the Ozone protocol. Those three parts are as follows:

- ***Ozone token ownership*** is secured by the underlying blockchain (*proof-of-stake* in the case of Ethereum). Any transfer of ownership or any transaction on the Ozone protocol, really, can be considered to have been confirmed with the same level of security as the underlying blockchain.
- ***Oxygen token distribution*** is governed by the Oxygen smart contract. The Oxygen smart contract dictates the distribution of the newly minted Oxygen tokens: it defines the rules for participation and conditions upon which actors are rewarded for their *good* behaviour or penalized for failing to fulfill their role.
- **Ozone Innovate Fund (OIF) proposal election[9]** is governed by a voting process based on the delegated proof of stake. Any member of the Ozone community — i.e., anyone holding Oxygen tokens — can (and is expected to) participate in the voting process. The greater the share of the token the member holds, the more voting power they have. Members can also elect to delegate their stake and voting rights to a *representative* they choose and deem more competent to make an informed decision. The representative, in turn, acquires proportionally more voting power. A similar mechanism is being implemented by projects such as Dash [14], Steem [10], and Polkadot[15].

[8] Bonding period is the period of time before being able to unbond and withdraw bonded stake

[9] Please see chapter Ozone Innovate Fund (OIF)

Ozone Application Layer

On top of the open-source protocol layer, an application layer will bring about complementary, non-essential but useful functionality. These additional building blocks grouped under the joint application umbrella should further simplify and streamline the transition of travel buyers and suppliers to the blockchain. Some or all of this additional functionality might not be open-source.

Just as — in world-wide-web terminology — mobile apps bring value-add products and services for the end-customer on top of the TCP/IP protocol layers, so will the Ozone application layer bring about various value-added applications on top of the core Ozone protocol. These applications should create better user experience and facilitate the growth of the Ozone platform. They might range from a buyer interface, supplier API, or to a payment system with integrated exchange for various fiat and crypto currencies — to name a few. More broadly, some typical examples the Ozone platform will consider implementing as well are a user-friendly interface, supplier API integrations, loyalty and referral programs, escrow service, insurance contracts, wallet, exchange API integrations, analytics platform, and more.

For instance, a user-friendly distributor interface for both buyers and suppliers and a unified distributor API should allow seamless and fast deployment of new distribution nodes. Also, the Ozone platform might support various value-add services connected with booking transactions. Such services might encompass loyalty or referral programs, or escrow service and insurance contracts. Additionally, an open-source `ERC721` wallet could be developed to display check-in, boarding, and other information associated with the owners' Ozone tokens. This would, in turn, streamline the user experience during travel all the while offering easy access to additional services built on top of the Ozone protocol. Further, the original booking contract might be enhanced with an application wrapper supporting payment in additional fiat and cryptocurrencies. Finally, Ozone will also consider implementing an advanced settlement smart contract to seamlessly settle accounts between different suppliers (e.g. codeshare airlines and airports).

Ozone might build some of those applications or might partner with third party providers in a joint effort to grow the use of the Ozone platform. Further, any third party wishing to enter the space and implement some additional functionality is open to build on top of the core (and open-source) Ozone protocol. In doing so, Ozone — together with the community of developers and enthusiasts — will be able to bring about useful services across the Ozone ecosystem.

Ozone Innovate Fund (OIF)

Ozone Innovate Fund (OIF) is the direct channel through which the community can participate in the development of the Ozone ecosystem. The fund can be used either to further enhance the core protocol or to build useful applications on top of it. We believe that a system which allows users to create and submit project proposals to enhance or extend the Ozone ecosystem would help create a better and more robust infrastructure and attract even more users, developers, and businesses to the platform. Through this vehicle, anyone can have agency in the future development of the Ozone ecosystem.

OIF is funded from two distinct sources: basis inflation and bonded stakes. Firstly, a certain percentage of tokens created through the aforementioned inflation mechanism is added to the OIF. Secondly, any tokens taken from bonded stakes due to a breach of slashing conditions will also be put into the fund. Funds drawn in this manner are then awarded to projects chosen through community voting. This process is detailed in the following.

Virtually any member of the Ozone community — anyone holding Oxygen tokens — can suggest a project that would benefit the Ozone ecosystem and request a budget for its development. A maximum and minimum budget size is set to allow for financing multiple projects at once. Further, a modest submission fee (later on also added to the fund) is set in order to reduce spam. Once a proposal is submitted, the community can vote if they wish to finance the respective project. Each vote is weighted by the voters' stake size. In every proposal election cycle, only a limited number of projects are chosen to be funded. Every member participating in the voting process is thus expected to critically evaluate proposals and vote in their own, and their network's best interest. We appreciate that some members will want to delegate their voting power to trusted individuals (representatives) that can allocate more time and resources to the process or have more domain knowledge to make an informed decision. To allow for this, we use a Liquid Democracy[10] governance model. Further, to prevent users with a high reputation from dominating the voting process, each user will be limited to voting for only a certain number of projects per voting cycle. Finally, once a project is chosen for funding, the requested number of funds is taken from the OIF and allocated to its development.

[10] Delegative democracy, also known as liquid democracy,[1] is a form of democratic control whereby an electorate vests voting power in delegates rather than in representatives.

Conclusion

The travel and tourism industry is a multi-billion-dollar industry that is among the largest and fastest growing industries worldwide. Still, booking today is expensive, complex, unreliable, and non-transparent. The space is characterized by monopolistic legacy inventory distributors that catalyze several intermediary layers between travel suppliers (airlines, hotels, car-rentals) and travel buyers (tourist agencies or end consumers).

Ozone works to render those intermediaries redundant by connecting travel buyers and travel suppliers directly over a distributed network. It runs an open-source, blockchain based booking protocol that does not depend on a trusted third party with centralized servers. The distributed network as such has no single point of failure, it is censorship resistant, and the data it runs is publicly verifiable. Information and power are distributed systematically by cutting out the middleman.

Ozone brings a number of benefits relative to the legacy systems. It reduces booking costs up to ten times; supports a breadth of value-add products and services; allows for open and transparent booking; and enhances security and reliability. Further, because each ticket is tokenized, it introduces a completely new business model — secondary marketplace. Finally, an open-source protocol is just a footing on top of which an entire ecosystem of third-parties and Ozone proprietary applications, features, and services — such as a user interface or supplier API — will be built to further promote distributed travel booking.

Ozone is set to disrupt a multi-billion-dollar travel booking space. Get on board for the new era of travel.

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