Boson Protocol White Paper (light version)
Decentralized Autonomous Commerce

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Abstract

We present Boson Protocol, decentralized infrastructure for enabling autonomous commercial exchanges on Ethereum. Boson is a peer-to-peer system which replicates the benefits of a market intermediary, without the disbenefits of centralized systems- which abuse trust by extracting excess profits and hoarding data, and existing decentralized systems- which add arbitration cost and friction. The protocol is a permissionless, generic mechanism for enabling the decentralized exchange of digital value for any product, service or *thing*, without centralized intermediaries and with minimized arbitration, trust and cost. Boson implements a 2-sided deposit structure within a dynamic game, which automates the mediation of disputes and mitigates reversal losses, by ensuring that both agents have skin in the game. Commerce data is pooled and equitably monetized within a secure, privacy-preserving, shared data layer with ownership retained by the individual. The system is community-owned, public infrastructure, which is resistant to capture. As such Boson represents a breakthrough in the scalable, automated coordination of commercial exchange with a vision:-
"To be the world's open, public infrastructure layer for commercial transactions and their data".

Document structure

The Boson Protocol white paper is structured as follows. The first section is an overview of the protocol, and can be read as a standalone 'Light Paper' (this document). The Overview has three sub-sections. A Background which describes the current situation and the problem which Boson Protocol addresses. Next, Vision & Objectives which specifies the solution requirements. Then, Boson Protocol Overview, which provides a high-level description of the protocol. Following the Overview section are separate sections detailing the Core Exchange Mechanism, Token Model, Governance and Technology. These subsequent sections are not required reading for a general understanding of the protocol (and are omitted from this version).

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Overview

Background

Online commerce coordinates the exchange of *monetary value* as digital payments, for *non-monetary value* as goods or services (henceforth *things*). Today, online commerce typically remains intermediated by two types of trusted third parties:

- **Financial intermediaries** for processing payments (e.g. MC, VS, Paypal)
- **Market intermediaries** for facilitating exchange (e.g. Amazon, eBay, Priority Pass)

Financial intermediaries

The challenge of replacing financial intermediaries with *"an electronic payment system based on cryptographic proof instead of trust*" (Nakamoto, 2008) was first met by Bitcoin. Satoshi's white paper addresses two problems caused by the cost of reversible transactions:

1. **Dispute mediation.** Reversible transactions require dispute mediation- which adds transaction costs.
2. **Reversal costs.** Sellers incur costs whenever payment transactions are reversed for non-reversible products and services.

Satoshi presents Bitcoin as a non-reversible payment solution which protects sellers from transaction reversal, and suggests that *"routine escrow mechanisms could easily be implemented to protect buyers"* (Nakamoto, 2008). So, whilst Bitcoin renders the monetary side of the transaction irreversible, the non-monetary, market side retains the cost of dispute mediation and reversal.

Market intermediaries

The management of dispute mediation and reversal is a primary function of market intermediaries. For centralized market intermediaries, dispute mediation and reversal costs are lost within the typically excess profits extracted by such platforms. For decentralized market intermediaries (such as Openbazaar and Origin), dispute mediation is typically performed by arbitrators and represents a visible and material additional cost. The impact of dispute mediation costs on otherwise free services, limits the *"minimum practical transaction size and cuts off the possibility for small casual transactions"* (Nakamoto, 2008). Further, the additional cost and friction, renders arbitrated protocols impractical for many use cases, particularly for machine-to-machine and decentralized applications.

Problem 1

The coordination of commercial transactions requires centralized intermediaries or decentralized arbitrators to manage dispute mediation and transaction reversal. This adds cost and trust, which limits the scope and reduces the efficiency of commerce.

Data silos

Data is a highly valuable component of online commerce. Market intermediaries capture and take ownership of a wide range of data including buyers' personal and product preference data, together with seller pricing, ratings and reviews. The value of this data derives from its ability to predict consumer buying behaviour, inform product development and provide market insight. Despite its utility, the vast majority of data is locked-away in the proprietary data silos of tech titans such as Amazon and eBay, or sold privately on the *shadow data economy*[1].

Extraction and capture

As they scale, centralized market intermediaries amass competitive advantage via their data troves, network effects and economies of scale. Such networks invariably move from cooperating with their participants to competing, and from attracting customers to extracting[2]. This is neither a coincidence nor a choice, since profit-making entities have a fiduciary responsibility to maximise shareholder value. An *extraction imperative*[3], if you will. Amazon is replete with examples. First, the EU alleged that Amazon was using competitively sensitive data gathered in its role as a marketplace -regarding marketplace sellers, their products and transactions- to unfairly advantage itself as a seller[4]. Second, Amazon has used this data to launch competing Amazon-branded products. Third, Amazon has vertically integrated into areas such as freight[5] so aggressively that it could soon become the world's largest freight company[6]. As a result, centralized market intermediaries have the means and motive to capture and dominate multiple markets.

Problem 2

Data collected from commercial transactions by centralized intermediaries is locked-away and used to strengthen anti-competitive market dominance which imperils the interests of the consumer, other firms and even governments.

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[1] "The Web3 Data Economy - Ocean Protocol." https://blog.oceanprotocol.com/the-web3-data-economy-b6fd8ecac4c4. Accessed 24 May. 2020.

[2] "Why Decentralization Matters - OneZero." 18 Feb. 2018, https://onezero.medium.com/why-decentralization-matters-5e3f79f7638e. Accessed 24 May. 2020.

[3] "The Future Of Network Effects: Tokenization and the End of ...." 17 Jul. 2018, https://medium.com/public-market/the-future-of-network-effects-tokenization-and-the-end-of-extraction-a0f895639ffb. Accessed 24 May. 2020.

[4] "Antitrust: EC opens formal investigation against ... - europa.eu." 17 Jul. 2019, https://europa.eu/rapid/press-release_IP-19-4291_en.htm. Accessed 24 May. 2020.

[5] "Amazon loses contract with FedEx Express as ... - The Verge." 7 Jun. 2019, https://www.theverge.com/2019/6/7/18656813/amazon-prime-fedex-express-delivery-logistics-network-contract-termination-usps-ups. Accessed 24 May. 2020.

[6] "Amazon Could Soon Be The World's Biggest Shipping Company." 24 Sep. 2019, https://www.forbes.com/sites/stephenmcbride1/2019/09/24/amazon-could-soon-be-the-worlds-biggest-shipping-company/. Accessed 24 May. 2020.

Challenge, Vision & Objectives

The Challenge

> *Is it possible to design a peer-to-peer system which replicates the benefits of a market intermediary, without the disbenefits of current centralized and decentralized systems? Such a system would coordinate economic exchange whilst minimizing trust and cost. Commerce data would be pooled within a secure, privacy-preserving, shared data layer and would be owned by the individual, and monetized in an equitable way. The system would be community-owned, public infrastructure, which would be resistant to capture and would be capable of out-innovating and out-competing entrenched incumbents.*

This is the challenge which we take-up and which we believe Boson Protocol has the potential to meet.

Vision

Boson Protocol's vision is:
"To be the world's open, public infrastructure layer for commercial transactions and their data "

Objectives

To achieve our vision we define a number of objectives and challenges as follows:

Decentralized coordination of economic exchange:

To design a decentralized protocol which coordinates the exchange of monetary for non-monetary value whilst minimizing arbitration friction and costs, so as to be widely applicable and practical.

This requires the following properties:

- **Arbitration minimized** - the core system is automated and requires human intervention from arbitrators as an exception only.
- **Trust minimized** - all parties can reach consensus on the truth without requiring a trusted third party, with arbitration as an exception only.
- **Practical atomicit**y - payment and receipt of goods happens together or not at all, so Buyers can trust that either they receive the goods or their money back, and Sellers can trust that they will be paid for goods supplied.
- **Incentive compatible** - the mechanism enforces system rules and ensures that there is no advantage to be gained by breaking the rules.
- **Practical and commercially acceptable** - the rules are simple enough to understand and use, and commercially acceptable to all parties.

Incentivization

To optimize the Boson Protocol Objective function:

maximize the supply of high quality voucher redemptions.

This requires that the system incentivizes:

- **Supply-side acquisition** and **demand-side distribution** of inventory.
- **Early adopters**, in order to overcome the chicken and egg effect.
- **Curation** and **redemption** of **quality** inventory.
- **Data sharing** and **monetization**.

Data

To develop a planetary-level Web3 data marketplace for commerce.

This requires the following properties:

- **Share, pool and monetize data** - in a secure, privacy-preserving and self-sovereign way.
- Incentivize voluntary **data sharing** via an **equitable distribution** of the value it creates.

Governance

To implement a governance model across the three phases of: start-up, scale-up and decentralize which will progressively enable the following properties:

- **fair and equitable distribution of ownership, value and control.**
- **capture resistance** - from centralized, extractive entities.
- **regulatory compliance**- with legitimate authorities.
- **community ownership and operation**.

Overall Protocol

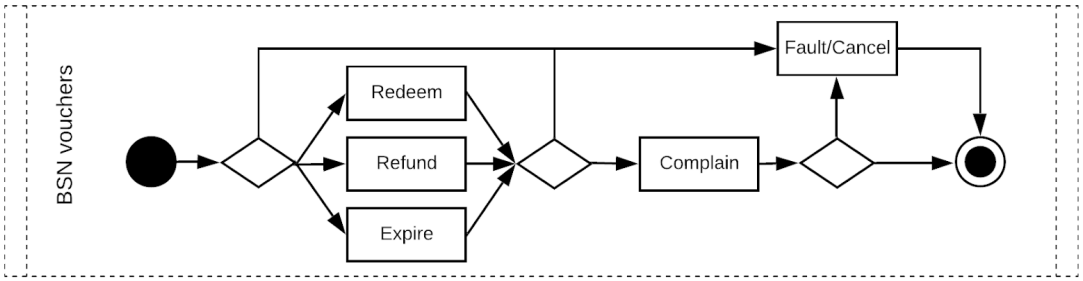
We aim for protocol-market fit, sustainable value capture and equitable value distribution.

Boson Protocol Overview

The vision for Boson: "To be the world's open, public infrastructure layer for commercial transactions and their data", is enabled by a design with five modular and substitutable components. First, a commitment to perform a future commercial exchange represented as a tokenized voucher. Second, a core mechanism for autonomous coordination of commercial exchange. Third, a token model for incentivising actors, and capturing and distributing value. Fourth, a Web3 data marketplace for monetizing data. And finally, an evolving governance system for directing and controlling the protocol throughout its lifecycle.

NFT Vouchers

Rather than tokenizing *things* directly, Boson instead represents *a promise to exchange digital value for a thing at a future date*, as a non-fungible token voucher (NFTV). Thus Boson NFTVs can be conceptualized as a type of futures contract for a thing. Boson contracts are implemented as stateful non-fungible token vouchers (NFTVs), whose states change as they flow through Boson's core exchange mechanism.



Events in a voucher's life cycle.

Core exchange mechanism

Boson's core exchange mechanism is sufficiently complex to manage the exchange, dispute mediations and reversals; but simple enough to be governed by a game. Boson NFVTs escrow three monetary amounts upon both parties' commitment to transact. First a payment amount is taken from the Buyer and is released to the Seller if, and only if, the Buyer cryptographically signs a redemption transaction. This ensures practical atomicity, by which we mean the transaction is as atomic as a cash transaction. Second, the Buyer transfers to escrow a deposit, which is held as a commitment for the Buyer to proceed with the transaction, and is forfeited should the Buyer reverse the transaction through no fault of the Seller. Third, the Seller transfers to escrow a deposit, which is held as commitment for the Seller to redeem the Boson NFVT for the thing, to an acceptable quality. These 2-sided deposits represent commitments within a dynamic game which minimizes arbitration by automating dispute mediation and reversal via an incentive compatible and commercially acceptable set of rules. The game's algorithm evolves over time towards increasing automation and decreasing arbitration.

It should be noted that the Boson core exchange mechanism constitutes a new primitive which can be used as a generic building block for enabling decentralized exchange with minimized trust and cost, across a wide range of contexts.

Token Model

Boson's token model is another modular building block, whose efficacy is judged by its ability to incentive actors towards optimisation of the system objectives. Boson's current architecture leverages Ocean Protocol's design for a Curated Proofs Market (CPM). Here, actors stake behind vouchers which they *predict* will optimize for the objective function: *maximize the supply of high quality voucher redemptions.* Actors are then rewarded with Boson tokens as a function of the amount staked, the timing of the stake (with increased rewards for early stakes) and the *actual* transaction value and quality.

Boson tokens are the native utility token for the protocol and are used to incentivize actions across the system. Firstly on the supply side, Bosons reward supply acquisition via *Aggregators and Sellers,* and supply quality via *Curators.* Secondly on the demand side, *Relayer* marketplaces earn fees In Bosons to incentivize distribution of inventory. Thirdly for data sharing, Buyers are incentivized to permit their data to be monetized in return for an equitable share of the value it creates. In addition, a token allocation is reserved to enable the system to incentivize early adopters and contributors. This enables the system to overcome the bootstrapping challenge and also funds development.

[N.B. At time of writing an alternative candidate for the Boson token model has emerged and is being assessed.]

Web 3 data marketplace

Web3 Data model

As a protocol for coordinating commercial exchange, Boson Protocol will be in a position to pool a valuable graph of consumer preference data. Whereas, Web 2 tech titans capture users' data and separate users from the value their data creates; Boson Protocol incentivizes voluntary data sharing by providing users with an equitable distribution of the proceeds from data monetization. Boson Protocol's strategic vision for data is to develop a planetary-level Web3 data marketplace for commerce.

Boson's design leverages an Ocean Protocol data marketplace to enable the pooling of data in a secure, privacy-preserving and self-sovereign way. Instead of locking-away valuable data within proprietary data silos, Boson's data marketplace makes data openly available for purchase. Data buyers may purchase personal, product preference, pricing and ratings data to predict consumer buying behaviour, inform product development or develop market insight. Further details of Boson's data marketplace will be released in a subsequent version of this white paper.

Governance

Boson will follow the pragmatic path of progressive decentralization[7] across three phases. First a centrally controlled *lean start-up* in order to achieve protocol-market fit. Then, once the protocol has developed defensibility via network effects, a minimally extractive fee will be levied on protocol services. This will be used to incentive a community of early adopters and contributors to scale-up the project. Finally Boson will fully decentralize to a DAO or similar, which will be structured to ensure regulatory compliance, whilst ensuring fair and equitable distribution of ownership, value and control.

Overall protocol

Boson is a protocol which enables decentralized autonomous commercial exchange, in a highly generic and unopinionated manner. The protocol functions as a commercial primitive or 'lego brick', thereby enabling digital and decentralized apps to be easily developed and integrated. This composability supports Boson's universal application and broad adoption in pursuit of protocol-market fit.

Whilst the protocol itself is minimally extractive, it possesses significant value capture potential. This, both as a standard for exchanging non-monetary value across the internet, and also as a planetary-level web 3 data marketplace for commerce. Boson redistributes value equitably to founders, investors, contributors, its community and users. With particular emphasis on early contributors.

Boson can be conceptualized in a variety of ways. First, as a set of smart contracts, components and standardized interfaces- think Amazon's APIs as a decentralized protocol. Second, as SMTP for transferring non-monetary value- think Bitcoin for transferring non-monetary value. Third, as a universal means to commit, store and transfer promises. Perhaps most thought provokingly, Boson is described in a tweet from Trent McConaghy:

https://twitter.com/trentmc0/status/1225344200885121025?s=20

[7] "Progressive Decentralization: A Playbook for Building Crypto ...." 9 Jan. 2020, https://a16z.com/2020/01/09/progressive-decentralization-crypto-product-management/. Accessed 2 Jun. 2020.

Use cases

Boson Protocol's universality spawns a wide range of use cases, a subset is described below:

Online commerce

- An open digital marketplace where any *thing* can be offered, searched and exchanged with minimized trust and cost.

Voucher distribution of non-monetary value

- The COVID 19 pandemic has increased the requirement for the distribution of food or essentials to those in need. Boson NFT vouchers enable this distribution in a highly automated, auditable and low-cost way

Machine-to-machine commerce

- Enabling autonomous cars to purchase tyres or servicing with autonomous management of disputes and redemption.

Loyalty and rewards

- Enabling loyalty programs and credit card rewards to offer any digital or physical thing in a standardized, composable and interoperable digitized format, without the cost and friction of intermediaries.

Games

- Enabling video games to gift or grant permission to buy rare or special items. For example, on reaching Grand Wizard status a player has the right to buy a special t-shirt.

Gaming

- Enabling blockchain gaming applications such as on-chain bingo to pay-out prizes in Boson NFVTs, redeemable for off-chain products.

Crypto exchanges

- Enabling exchange tokens to be redeemed for real world rewards in order to differentiate on rewards rather than compete on fees, whilst increasing token value.
- Enabling exchange users to purchase real world items directly from an exchange marketplace, without touching fiat.

Service bookings

- Enable bookings for any service from restaurants to collection of groceries to be secured via two-sided deposits, to ensure that Buyer and Seller meet their commitments to redemption and terms.

Tokenized networks

- Enabling users to exchange their network tokens for digital and physical goods and services, in order to increase user perceived value and token value.