iomob

THE INTERNET OF MOBILITY

PRODUCT WHITE PAPER

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Please refer to our legal **disclaimer** before reading this document

1. Introduction

Players in the mobility space can be divided into two broad groups, end-users aside: mobility providers, who provide means to transport people, and mobility facilitators, who build and run software platforms that interconnect mobility demand with suitable providers.
For example, in the taxi and ride hailing industry, both an independent taxi driver and a taxi company are mobility providers; MyTaxi is a facilitator; and Uber is both a provider and a facilitator, since it operates both a fleet of drivers and the technology stack for customers to book rides with a mobile app.

The goal of **iomob** is to decentralize mobility and build the Internet of Mobility. That is, to build a shared common infrastructure for the various players in the mobility arena to collaborate without relying on a proprietary, closed, centralized software platform infrastructure. Instead, in **iomob**, mobility providers can announce their services to mobility hubs, and end-user apps can discover suitable providers to fulfill the needs of their users.

The main advantage of such a decentralized approach is that this basic infrastructure is not under any organization's control (including its founders). Mobility facilitators are currently private, profit-seeking companies that attempt to capture a large share of the market, and hold it captive to extract as much value as they can. This harms the other players, both the providers, which are forced to share an excessive share of their revenue with facilitators, and smaller facilitators, which do not achieve the necessary network effects and struggle to stay in business.

In **iomob**, no player can gain a dominant position. All players are compatible and interoperable, since they speak the same **iomob** protocol, are commoditized by design. They both compete and cooperate in a level playing field to provide value to end-customers and the mobility ecosystem as a whole. Therefore, a misbehaving player (who, for example, sets excessively high fees) can be replaced by another one that is more efficient.

iomob aims at becoming the definitive infrastructure to facilitate mobility globally. As such, it features minimal platform fees. **iomob** is quasi-free to use, and close to a peak predator of capitalism, that is, a system which produces a useful output at the lowest possible marginal cost [TokCurReg]. Contrary to closed platforms that currently exist, the various stakeholders enter spontaneous commercial arrangements where parties compensate one another for the value they bring to the network; but the network itself does not attempt capture the value of the mobility market.

iomob will fund its own development and incentivize its growth via a token economy by minting cryptographic tokens that have a valuable use within **iomob**, issuing token sales, and even granting them as a mechanism to encourage adoption.

The design of **iomob** is practically minded and is geared at enabling fast, massive adoption. It considers the scalability limits of current blockchain technology and does not force end-users to be proficient in cryptocurrency and token use; for this reason, **iomob** supports payments in fiat currency by end-users.

Section 2 below describes the architecture of **iomob**, its design, and how the various players cooperate and compete on top of it. Section 3 introduces the cryptoeconomic design, which features a token that plays a central role in **iomob**; in particular, in incentivizing its growth. Finally, Section 4 presents our development plans and Section 5 concludes the product white paper.

We also invite you to read our white paper available at **www.iomob.net**

2. Technical Architecture

The iomob Protocol

At the core of this architecture is the **iomob** Protocol. This open protocol is used by mobility providers to announce the services they offer. The protocol supports various modes of mobility. For example, a taxi cab can declare its availability and current location, a bus can announce its route and schedule, and a carsharing company can publish the position of the cars in its fleet. **iomob** aims at being general and permissionless so that any organization or individual can participate in the network.

Messages in the protocol are standardized. Announcements of mobility services are sent to mobility hubs run by independent companies. Hubs receive and store such messages, and offer a standardized API for end-user applications (usually, mobile apps in the hands of citizens) to request the mobility services they require. Hubs return suitable providers to apps; users can then purchase such services via the apps, again with standardized messages that are sent to hubs and relayed to mobility providers.

In practice, there are more stakeholders than the mobility providers, hubs, and end-user applications we have identified so far. We shall focus on these three for now for the sake of simplicity.

All of the three stakeholders provide value to the end-user. Therefore, they must be compensated for their efforts in order for the ecosystem to be sustainable. Usually, the mobility provider provides the bulk of the value in actually delivering the required mobility service. Hubs contribute to the discoverability of such services, and incur costs in building and operating the computer infrastructure to that end. Finally, applications offer an interface for end-users to request mobility services, usually via apps that they have to develop, maintain, and promote to grow their user base.

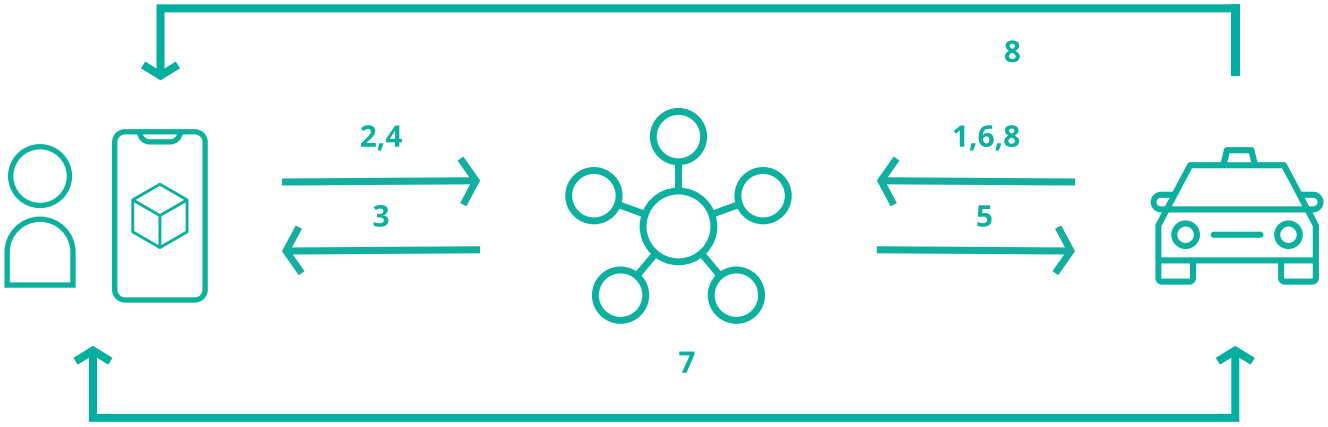
iomob is agnostic to how revenues are split among the players. It allows parties to negotiate the revenue split as they see fit, and enforces the agreed terms. Since the smart contracts of **iomob** can enforce the agreed revenue splits, participants do not need to establish explicit partnerships nor trust a counterparty to respect any agreements.

By standardizing the roles in the mobility ecosystem, as well as the processes and communication interfaces through which they interact, we enable a free market where players both collaborate to deliver mobility services and compete to fulfill certain roles as efficiently as they can. Stakeholders that bring value for the lowest cost will be favored over others that are more inefficient or that attempt to capture a disproportionate share of the value of a mobility service. All players are to an extent commoditized; no player can abuse a position of dominance, since it can be readily replaced.

How is revenue split in practice? Mobility providers send messages called mobility offers to announce their services to hubs. End-user applications request mobility services to hubs via messages called mobility requests, to which hubs reply with a list of matching offers. Hubs attach to these offers a hub fee they expect to collect if a service is actually booked. When a user books a mobility service, the app attaches an app fee and sends a booking request to a hub.

The booking request includes, then, a hub and app fee (and, possibly, others; this will be later discussed). A booking request from a user is then forwarded to the provider. It is then up to the provider to accept the booking, considering the fees it will have to pay for the whole service. If the provider accepts the booking, it signs an acceptance message with its private key, thereby accepting the responsibility of both performing the service and paying the required fees to the other stakeholders. Mobility services can be cancelled by the provider or the passenger, according to pre-established rules called cancellation policies embedded in mobility offers.

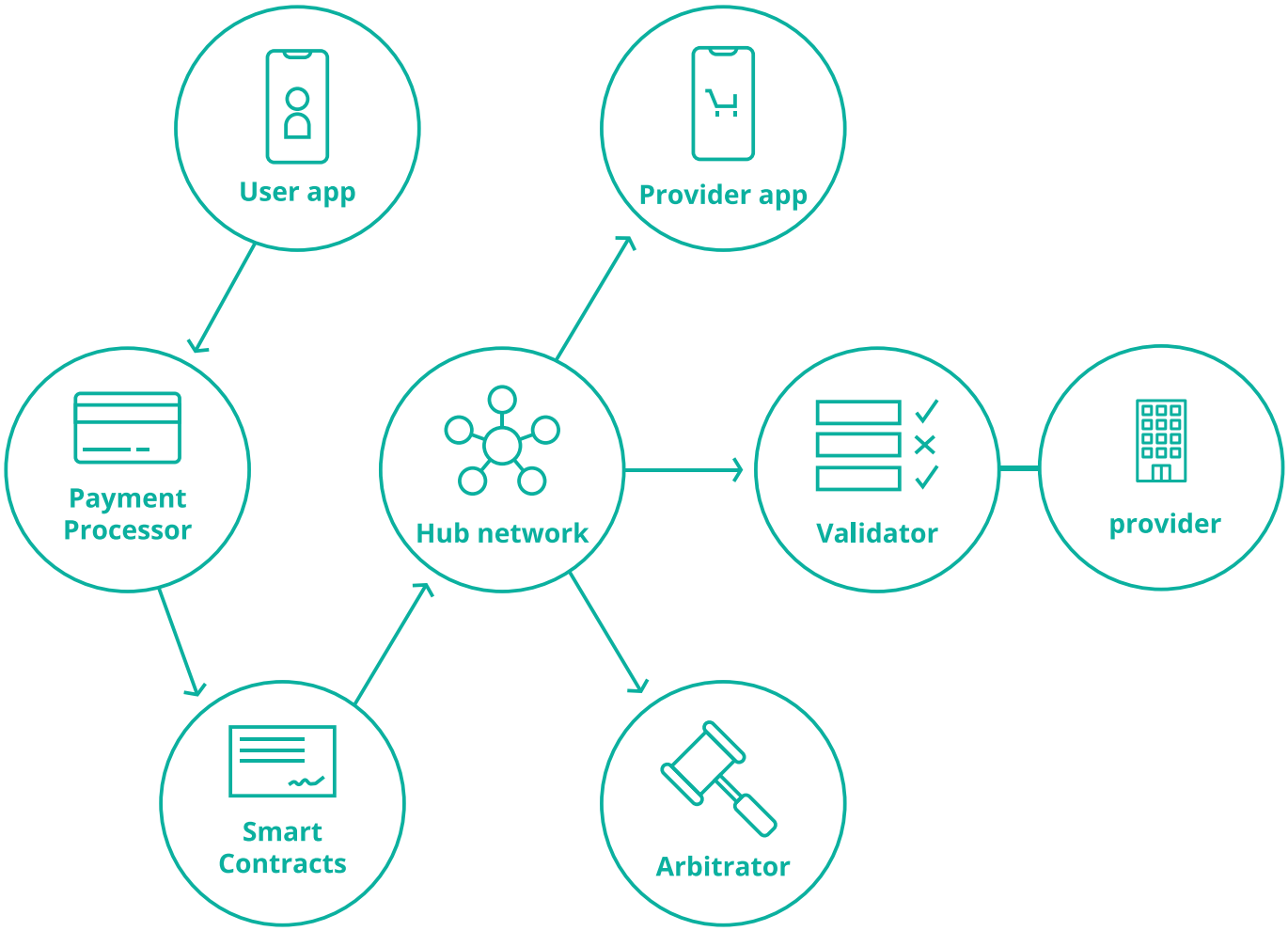
The following diagram shows an example mobility service:



1. Available taxis announce their position via mobility offer messages sent to hubs.
2. An app sends a mobility request to a hub.
3. The hub selects matching offers, and announces them to the app, attaching a hub fee.
4. The app sends a booking request to hub that includes an app fee.
5. The hub forwards the request to the mobility provider (including both hub and app fee).
6. If the mobility provider accepts booking, signs the booking message with its private key.
7. The mobility service is performed, and collects payment.
8. The mobility provider sends fees to the mobility provider and the developer of the app.

If disputes arise, for example, because cancellation policies are not respected, entities called arbitrators can resolve them. However, for inexpensive mobility services, this is often too expensive to be practical; for such services cancellation policies are very flexible to minimize disputes. Still, when services are cancelled, hubs (and other players) lose revenue; hence, hubs can penalize both service providers (by requesting higher fees or prioritizing other providers to service mobility requests) and customers (by prioritizing other passengers or even refusing service) that engage in excessive cancellations or no-shows.

Besides hubs, apps, mobility providers, and arbitrators, other actors can provide services. The diagram below summarizes the ecosystem and payment flows of **iomob**, including these additional actors who can contribute services such as verifiably processing payments, validating that players conform to regulatory frameworks, or providing insurance to end-users or providers. All these players demand fees of their own. Payment processors collect payments from users and relay them to smart contracts that ensure each party can collect the fees as agreed. (Smart contracts also hold information such as identities and reputation of users of iomob, but this is not represented in the diagram.)



Smart Contracts

The smart contracts of **iomob** provide a guarantee that all stakeholders get paid the agreed fees. **iomob** Protocol messages in which fees are agreed are cryptographically signed, so that it is impossible for any party to forge or modify them. The smart contracts are able to interpret such messages, verify their authenticity, and ensure that the fees agreed in each message are paid.

In order to participate in the protocol, every stakeholder must lock funds in an **iomob** smart contract. All players ignore a stakeholder that attempts to participate in the network without maintaining a sufficient balance in the smart contract; **iomob** smart contracts hold these funds in escrow. At any time, a player can ask the smart contract to transfer them funds that are owed by a counterparty to collect fees forcefully, by submitting proof of an agreed fee.

Blockchain Layer and Scalability

The architecture of **iomob** addresses a key practical constraint in today's blockchains: transactions are currently costly, in the order of several cents of a dollar in the case of mainstream public networks such as Ethereum and Bitcoin as of this writing. Two architectural decisions have been made to take into account this practical issue.

Firstly, the architecture is split in two layers. The blockchain-powered layer is primarily concerned with overseeing economic transactions (usually between mobility providers, since end-users can pay in fiat); most of the interactions between stakeholders are performed in an off-chain layer. This way, most of the messages exchanged by players do not hit the blockchain and therefore do not require paying the associated transaction fees. Secondly, micropayments are not implemented via on-chain transactions. Instead, they are periodically netted and settled using a technology called payment channels [Layer2Scaling] where, essentially, parties exchange cryptographically signed IOUs that can at any time be relayed to a smart contract that holds funds in escrow.

It is our view that, of all blockchain projects, Ethereum has accrued the largest critical mass of developers. There is a vibrant community focused on reducing transaction costs by increasing the scalability of the Ethereum blockchain. This will be accomplished by a combination of strategies: switching from Proof-of-Work to Proof-of-Stake to replace miner fees for staking rewards, the implementation of sharding, and promising second-layer technologies including [Plasma] and state/payment channel tech [Raiden, Counterfactual]. Besides research and development in these core areas, Ethereum has a large and growing community of developers of decentralized applications building on top of it, and it currently has the best tooling support of any smart contract platform. For these reasons, **iomob**'s blockchain layer builds on Ethereum and its Ethereum Virtual Machine as a core technology.

However, even with our two-layered approach, transaction costs and network capacity on the Ethereum mainnet are currently limiting for our purposes. **iomob** will initially run on a permissioned public Ethereum network that uses Proof-of-Authority as a consensus mechanism. This will provide a stable, proven, transparent environment that guarantees bounded transaction costs and sufficient throughput. Blockchain scalability is an active area of research that we will be monitoring, and we will eventually migrate it to a scalable, permissionless, fully decentralized network. Migration to the Ethereum mainnet may become feasible once sharding is implemented. Plasma sidechains that inherit their security from the Ethereum mainnet also show great promise. So do DPoS sidechains such as [Loom] DAppChains.

Additionally, blockchain interoperability projects like [Cosmos], [AION] and [Polkadot] may also provide a suitable technological basis to fully decentralize **iomob**, for example, by running the protocol on a Polkadot parachain linked to major blockchains.

To guide our choices and navigate the tradeoffs that these technologies will offer, we will observe the following principles.

1. **Practicality.** **iomob** is first and foremost a production network that aims to solve needs for its users now. We will prioritize working tech over theoretically superior alternatives that lack a usable, production-ready implementation.

2. **Decentralization.** We are promoting a self-sustaining ecosystem that does not depend on our team to function. We therefore aim to remove our control over the ecosystem to the maximum degree.

Payment Processing

End-users of mobility services should not be expected to be aware of the existence of the **iomob** token nor the intricacies of the underlying technologies. Instead, user-facing apps hide the architecture and inner workings of **iomob** from the user, and payments by end users are made using fiat currencies. (In the future, as cryptocurrencies flourish, mobility providers may desire collecting payments in tokens or cryptocurrencies).

Revenue sharing agreements are enforced by the blockchain. If a party collects payment from a party on behalf of another one, they are fully settled on-chain. To avoid exchange rate risk payments are converted to stablecoins (e.g., [Dai]; stablecoins are cryptocurrencies that are pegged to stable assets such as fiat currencies or gold).

In the case of credit card payments, there is a risk of chargebacks (reversal of payments). In **iomob**, a payment processor can absorb this risk and charge the appropriate fees for it. (Payment mechanics are described further ahead in section "Cryptoeconomic design".)

Mobility Hubs

Mobility hubs receive messages informing them of the availability of mobility services sent by providers. Hubs span a well-defined geographical scope, in a non-exclusive fashion, i.e., many hubs can service an area, and are responsible for acting in observance of the regulatory framework within that scope. For example, in an area where taxi services require a license, only taxis in possession of a valid license are allowed in the hub.

Hubs do not validate this themselves; this is the job of a set of actors called compliance validators described below. The organization running a hub establishes relationships of trust with compliance validators that are in charge of actually verifying mobility providers, and a hub only trusts mobility providers that have been vetted by validators it trusts. Hubs must obtain the necessary level of validation according to the regulatory frameworks where they operate.

Hubs also provide a means for end-users and mobility providers to communicate, since they have established communication channels with both. This is not regulated by the protocol, but it is in the best interest of hubs to enable communication between parties so they can resolve minor difficulties (for example, a short text messaging session can allow a driver to locate a passenger effortlessly; no driver will work on a hub that does not enable this). Hubs can monitor such communication channels, and messages can be forwarded to an arbitrator if a dispute arises. After a service is performed, the communication channel closes, regardless of whether a dispute emerges.

Finally, hubs are allowed to relay mobility requests to other hubs, possibly adding extra fees, to attempt to service mobility requests it cannot fulfill.

Mobility Providers

Any kind of mobility provider can participate in **iomob**. This can include taxi companies, ridesharing companies, public transport networks, car rental companies, or bicycle rental shops. Such companies are bound to obey certain regulations to customers, and, in some cases, they must also verify their customers are in compliance with local laws and regulations.

Hubs validate providers are in compliance with relevant regulations by relying on compliance validators. In turn, providers may rely on validators to ensure their customers are in compliance as well.

For example, a car rental company may require verifying drivers are adults in possession of a driver's license. They may choose to do that internally, but trusting validators enables network effects: customers validated in other countries, or who were validated in connection with services originally offered by themselves or their competitors in the same or other hubs can be readily onboarded.

Compliance Validators

Compliance validators run checks on the identities and adherence to regulations of other stakeholders (usually, mobility providers and end-users). For example, in the taxi industry, a validator may be able to verify taxi licenses, and another one may be capable of verifying whether a particular taxi can perform service a specific day of the week or other arbitrary regulations on the industry. Conversely, a validator may also verify the identity of a user and that, for example, they are in possession of a valid driver's license and of legal age in connection with a car rental, or an active cell phone number.

In exchange for their contribution, validators obtain fees from each service as agreed between parties, and their compensation too is ingrained in the **iomob** protocol.

User Applications

User-facing applications perform three crucial services to the **iomob** network. First, they produce usable front-ends to book mobility services from the providers participating in the **iomob** network, while hiding its underlying complexities. Second, they bring users into the network, engaging in marketing efforts to indirectly promote the mobility services in the network. Third, they can collect payments on behalf of the mobility provider (and the rest of the players in the network).

Such applications are usually mobile apps, but can also be websites or other kinds of software applications and front-ends.

Applications can express certain preferences (e.g. do they prefer the fastest, cheapest, or most environmentally responsible journey). The API between hubs offers a way to express such preferences, and hubs can present several alternatives for the user to choose from (e.g. a nearby taxi arriving in around 2 minutes, an electric taxi arriving in 10 minutes, or a 30-minute bike rental).

Creating, maintaining, and marketing end-user applications is resource intensive and adds essential value to the **iomob** network, so applications can set fees for the mobility services booked by their users to recoup their costs and make profits.

It is worth noting that, in **iomob**, applications cannot rely on a captive user base, but are forced to compete on price and/or features. We expect this property of **iomob** will promote healthy competition in the app space to incorporate the best mobility front-ends and apps.

Arbitrators

To forestall disputes, **iomob**-powered announcements of mobility services include cancellation policies that may result in penalties for either side, but do not require manual (and comparatively costly) intervention.

However, the need for dispute resolution may still arise. Organizations devoted to dispute resolution may be appointed. In the case that a mobility service enters a "disputed" state, the arbitrators will emit a verdict. Certain outcomes may be enforced programmatically (such as a refund) or not (such as the payment of a penalty). Arbitrators may escalate a complaint to a regulator, and simply communicate the outcome to the **iomob** network.

Arbitrators are optionally appointed by mutual agreement of all involved parties before a service is booked, with an associated fee. This fee can be payable when a dispute does arise, or as a fixed transaction cost associated to a mobility service.

Reputation and Feedback

As explained, in low-value modes of mobility, manual dispute resolution is often too expensive to be practical. To prevent disputes, and to promote the best user experience for all parties that participate in **iomob**, from users to providers, the network has built-in reputation and feedback mechanisms to promote desirable behavior.

Cancellations in either side of a service are recorded. When a mobility service finishes, users and providers rate one another. Such ratings are stored on the blockchain. This way, a hub can penalize users and providers who tend to cancel booked services or fail to show up. Note also that not only users and providers are rated; indirectly, a rating also reflects upon user-facing and provider-facing applications. If certain apps result in bad user experiences, hubs have a direct interest in penalizing them, since, the more cancellations and dissatisfaction, the less fees the hub can expect to collect in the future, since the users may flock to other hubs (or abandon the network altogether!).

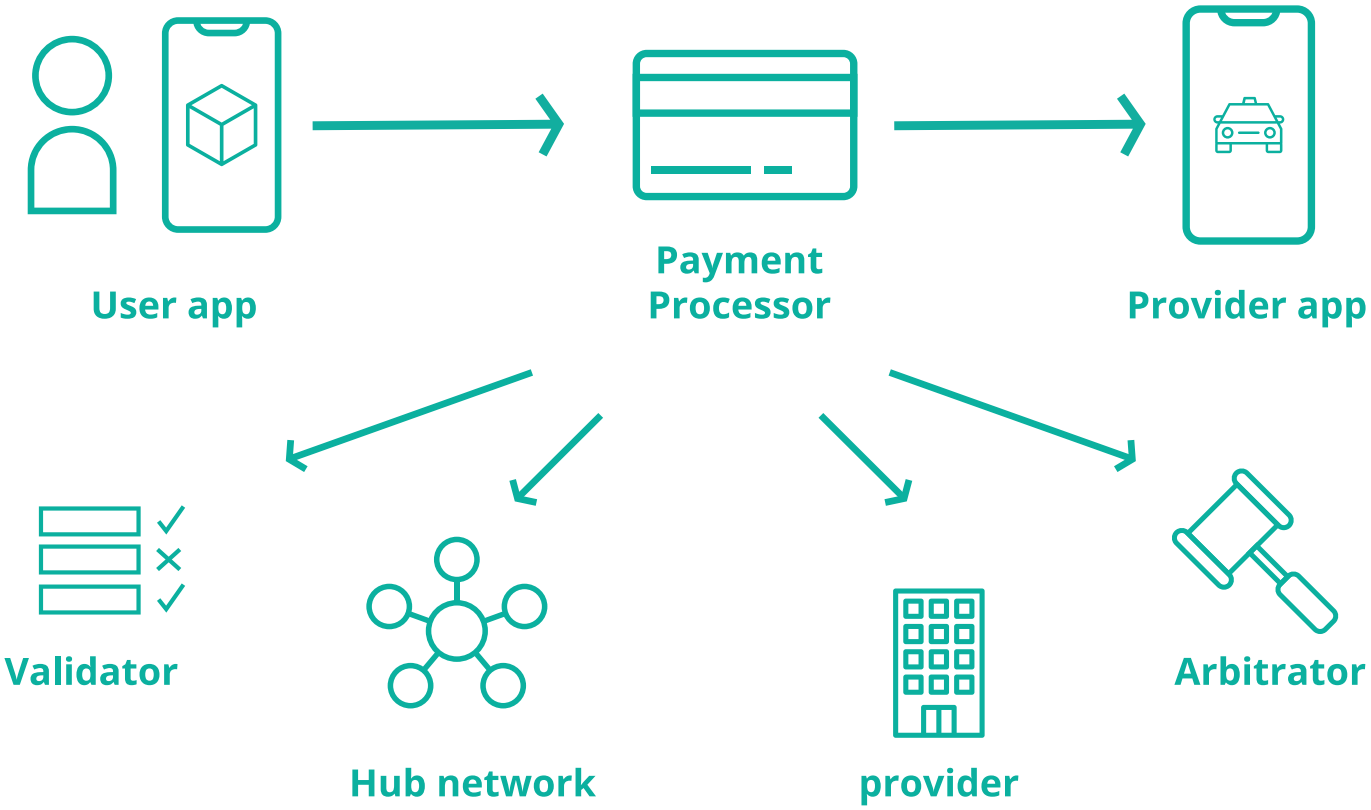
In order to attach feedback to each player, all participants in **iomob** must hold an [ERC-725] type identity. This serves not only to attach feedback to each identity, but also for validators to attach information to each identity. However, until [Ethereum] gains scalability and the ability to process transactions cheaply, feedback data can be stored off-chain and/or on a sidechain.

Feedback from actors (especially, end-users, but also mobility providers on end-users) will be multi-dimensional, including factors such as the timely delivery of the service (e.g., whether a taxi hailing was serviced quickly), safety, and overall satisfaction.

Note that reputation will be stored by the **iomob** network globally, and not only the hub and mobility operator where a service is booked; this enables an actor's reputation to be used by other counterparties to make more informed decisions, further strengthening the network effect. For example, an insurance provider for car sharing may leverage the reputation that an end-user has gained while using other **iomob**-enabled services in its assessment of the risk associated to said end-user.

Players and Exchange of Value

The following diagram summarizes the players in the **iomob** network and how value is exchanged. The **iomob** smart contracts guarantee that each of the players can collect their share of value from any mobility service.



3. Cryptoeconomic Design

iomob is a decentralized, permissionless, self-sustaining network. Its architecture features a combination of an open protocol to announce and purchase mobility services, a set of smart contracts that regulate value exchanges between players, and off-chain components that facilitate and perform mobility services with periodic, on-chain settlements.

In this section we describe the cryptoeconomic design of **iomob**. The objectives of our design are the following:

1.make it possible to hide the underlying complexity of the network from end-users,
2. facilitate the exchange of value and payments between stakeholders,
3. implement economic incentives to reward/punish wanted/unwanted behaviors,
4. and, in particular, promote early adoption and continued growth of the **iomob** network,
5. enable the funding of the development, maintenance and improvement of **iomob**.

The following subsections describe the payments architecture and a network-specific token, along with its utility within the network, and how it will be distributed among participants.

Payments from End-Users

As a consequence of design objective (1) we constrain ourselves to designs that are eminently practical and would not thwart adoption, considering the currently-low level of adoption of cryptocurrencies and crypto-tokens by the general public.

We expect an array of independently developed, competing end-user applications to emerge. While we will not (and cannot) control their design, it is reasonable to expect successful applications to hide the intricacies of **iomob** (its protocol, smart contracts, ecosystem of vendors, and cryptoeconomic design) from its end-users.

An application may or may not implement a wallet to hold IOM tokens (as later described), but end-users must not be expected to purchase any tokens to pay for mobility services nor to pay directly for the execution of smart contracts [Ethereum].

Therefore, **iomob** allows payments by end customers to be made in fiat, either in cash or via credit card; the adoption of **iomob** would be a lost cause if it mandated payments in cryptocurrencies or tokens, since its success would completely depend on the education of end-users on cryptographic tokens, which is not a realistic short to mid term scenario. **iomob** payment processors may nevertheless allow for payments in cryptocurrencies, including ether and other tokens [ERC-20].

The IOM Token

While we do not want adoption by end-users to depend on the use of a cryptographic tokens or cryptocurrencies, **iomob** does introduce a network-specific token called IOM.

The introduction of a token with a value that free-floats other tokens and currencies introduces a degree of freedom in its cryptoeconomic design and, in particular, enables the implementation of incentives

for the adoption of **iomob** that would not be otherwise possible. It also allows a potential increase in value due to its growing adoption to result in increased funds for its development and growth. In the following subsections we describe the utility of the token and how it is distributed.

Technically, **iomob** tokens are implemented on the [Ethereum] public network and are compatible with the [ERC-20] token standard. This way, IOM tokens are interoperable with mainstream Ethereum wallets, such as the [MyEtherWallet] software wallet and the various hardware wallets in the market. Also, they can readily be listed for trading by cryptocurrency exchanges with minimal effort from their side.

Token Utility

IOM is required for the various players to participate in the **iomob** network, except for end-users. In particular, IOM tokens are exchanged to settle payments between parties, and must be burned or locked to perform certain operations, and represent a right to participate in the governance of the network.

Platform access. Transacting on the **iomob** network will require locking a balance of tokens. Participants will need to lock tokens to register as a hub, validator, mobility provider, or end-user app. The exception is end-users, who will not be required to hold tokens to participate (although they can hold and spend them; for example, they can receive mined tokens they can use to pay for rides).

Token staking. The deposits described above will be locked for a period of time. Deposits will further incentivize the correct behaviour of all concerned players, since bad actors can be punished via slashing their deposits. For example, hubs that fail to disclose anonymized trip data as authorized by users, or mobility providers with consistently low ratings can be slashed. This creates a stronger incentive to respect the protocol and playing fairly, since it results in a direct financial loss and, potentially, the loss of the privilege to operate on the network.

Spam prevention. Besides on-chain transactions, second-layer operations impose a cost on a counterpart and the network as a whole, but do not merit a direct payment. For example, announcements of mobility services cause hubs to spend computing resources maintaining this information, hence, such messages merit micropayments that discourage abuse. At the same time, hubs should not receive payment for receiving them; their incentive should be solely to match mobility offers to their demand. Any message that implies resource consumption from counterparts implies such a micropayment, or, to

use a better terminology, microburn, including sending a mobility offer to a hub, a request for mobility services, and the message exchange that leads to a booking. These are implemented using point-to-point State Channels [Layer2Scaling] denominated in IOM. The minimum microburning fees are set network-wide as part of protocol governance (see below), but can be raised by participants dynamically.

Governance. The founders of **iomob** will design, implement and oversee the **iomob** network in its infancy. However, in the long term, the governance of the protocol is handed to token holders to ensure **iomob** endures as a Decentralized Application (using the nomenclature of [DTerminology]) that is not under control of any organization, and token holders will get a vote on platform fees, staking requirements, required token microburns, and other parameters. Implementing the means for decentralized governance is complex. In the interim, governance will be handed to a nonprofit foundation..

Discounts. End-users will receive cryptoincentives in the form of IOM tokens. These tokens will only be redeemable to obtain discounts on payments to service providers that operate on the **iomob** network. These discounts will be bounded to a maximum percentage of the cost (e.g., a maximum discount of 20%), since the main objective of such incentives is to encourage repeated use of the **iomob** network.

Data Sharing and Monetization: Data Commons Marketplace

The **iomob** network will produce a great amount of data on mobility patterns that are of significant interest to a range of organizations; in particular, research institutions, city-wide mobility planners, and mobility companies themselves.

It would not be fair to let any one player monetize such data unilaterally without control, and without letting ecosystem participate in the value they jointly create. Hubs in particular are in a privileged position to monetize this data, since in their role as facilitators they have access to detailed information for a large amount of inter-modal mobility services. For this reason, the protocol will set rules on what information can or must be released, under what conditions, and the associated exchanges of value.

Any requests for mobility from and end-user will explicitly allow or disallow publication. No hubs are allowed to disclose or in any way monetize data from end-users, unless explicitly authorized by end-users. By virtue of operating in the network, hubs are forbidden from releasing data in any way except using the mechanisms that the **iomob** network provides, and no other participants are authorized to share end-user data with third parties. It is important to note that emerging regulations around data privacy, particularly the European Union's GDPR (General Data Protection Regulation), must be adhered to. **iomob** is consulting with experts to ensure the final design will be GDPR compliant.

Hubs will offer provably random samples of trips to interested counterparties at a network-wide set maximum price per sample. Data on samples will be obfuscated according to anonymization policies set by end-users (data samples will presumably be priced differently depending on the attached anonymization policy). The proceeds obtained by hubs will be shared with the end-users that authorized the publication of their data. Users will then be able to use these tokens to pay for mobility services, serving as a rebate.

Hubs will be forced to sell the information at the network-wide price. This is because we believe that hubs should not exploit their privileged position to monetize this information at a maximum profit. We believe the **iomob** network can produce a trove of data that can help cities operate more efficiently by forcing the controlled release of information on mobility patterns at a reasonable price, so that entities (startups, large companies, government bodies, or research institutions alike) have access to it.

This is an important feature for the aggregate value of the network. For this reason, the protocol will force hubs to release the information they collect on-chain, and if hubs fail to provide an unbiased, random sample of mobility services they have offered, they will be punished by losing part of the deposit they have put forward to participate in the network (as described above).

Token Distribution

As explained, the cryptoeconomic design must provide a means to fund the development and operation of **iomob**, as well as promote its adoption and growth.

The initial and continued development of **iomob** requires a financial incentive for its founding team, attracting investors at an early stage, and then attracting funds after the network is operational. The IOM token plays a central role in these.

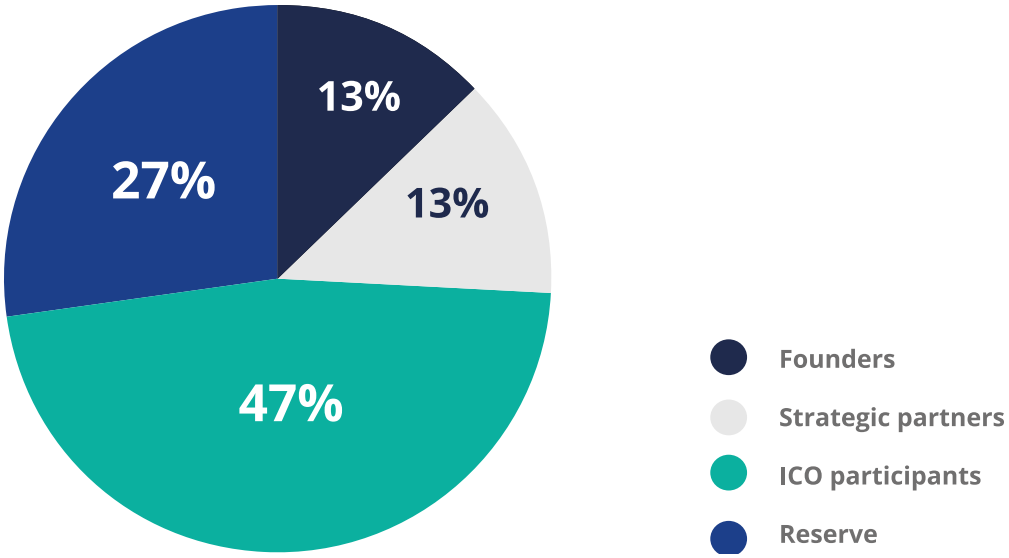
At genesis, a number of IOM tokens will be minted. These tokens will be split among founders, early investors, and the company promoting **iomob**. In a second round of minting, tokens will be issued for a public Initial Coin Offering, as well as for a nonprofit foundation in charge of overseeing the development and growth of the **iomob** network. Finally, tokens will be mined according to a predefined schedule by good actors of the network, whose behavior we want to incentivize.

Genesis Stage

At genesis, 2 billion tokens will be minted. These tokens will be allocated to founders and early strategic partners. To avoid perverse incentives, these tokens are not immediately under the control of their recipients. Tokens for founders are time-locked, so that they act as a financial incentive that is aligned with the mid to long-term success of **iomob**. The use of tokens by early investors is also restricted to prevent them from crashing the value of the IOM token in an early developing market, which can negatively impact the follow-up initial coin offering.

Production Stage

Once iomob is operational, an additional 5.5 billion tokens will be minted, for a total of 7.5 billion tokens. Of these newly minted tokens, 3.5 billion tokens will be offered to ICO participants, and 2 billion will be held by **iomob** to fund further development. **iomob** will be free to use these tokens for various tasks, including but not limited to building open source software, researching solutions to open problems, subsidizing the adoption of **iomob** by big players, funding startups in the mobility space, and operations.



Token Alocation - Production Stage

Growth Stage and Token Mining

One of the main advantages of our cryptoeconomic design featuring an **iomob**-specific token throughout the network is that it introduces the freedom to mine additional tokens to incentivize the growth of the network.

The total number of tokens will stay bounded to a total of 10 billion, that is, a maximum of 2.5 billion tokens will be mined. Tokens will be mined when actions that benefit the adoption and growth of the **iomob** network as a whole, which we call conversions, take place. Examples of conversions include the verification of an end-user's cell phone number and/or credit card, the validation of a taxi driver's license, or the delivery of a mobility service handled through a hub involving the coordination of independent providers. Each kind of conversion will lead to mining a certain amount of tokens, according to factors such as their difficulty, desirability, verifiability, and robustness to fraud of the associated conversion.

Of course, when a financial incentive is present, we expect bad actors to attempt to collect them fraudulently. In order to prevent fraud (that is, bad actors trying to trick the network into awarding mining rewards for artificious or entirely fictitious conversions), we shall establish requirements for collecting

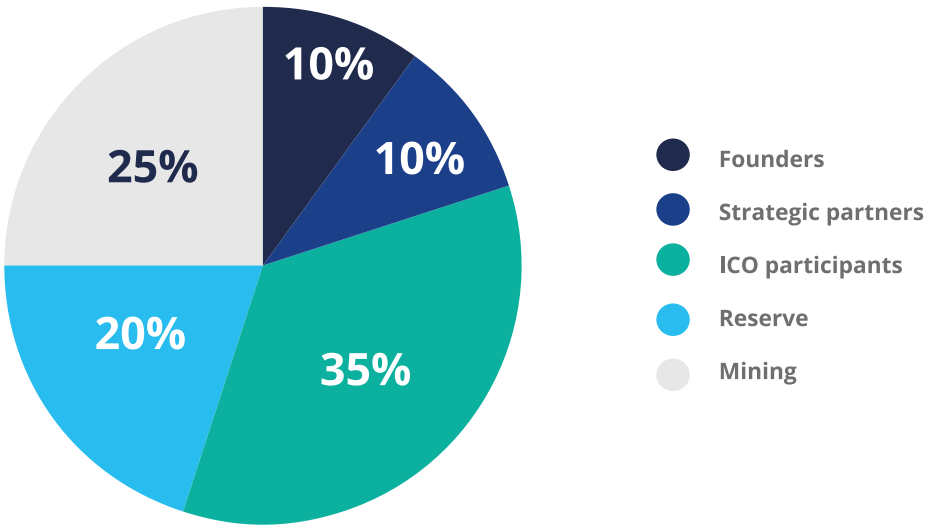
mining rewards. For example, only identities verified by approved validators will be considered eligible, and only mobility services that were verifiably carried out and resulted in with verifiable payments made by approved payment processors will be considered eligible.

Eligibility shall be determined by The **iomob** Foundation, or **iomob** Technologies. while the foundation does not exist. We are aware that this introduces a measure of unwanted centralization in **iomob**. However, it must be considered that these rewards 1) are opt-in, so the network remains permissionless if rewards are disregarded, and 2) these rewards are a temporary mechanism in place to incentivize the early growth of the network, and are not intended to be permanent.

Mining rewards are shared by the players that intervene in a conversion. In the case of the verification of an end-user, these are the app, and the validator. In the case of a mobility service, this corresponds to all the stakeholders involved: apps, hubs, validators, payment processors, mobility providers, and so on. We expect end-user apps to pass part of the incentives to end-users; for example, they can award a discount on the first mobility service they perform, or otherwise reward them as part of their marketing strategy.

Token Mining rates will diminish with time and the growth of the network, since their main objective is to incentivize the growth of the network. As explained, a maximum of 6 billion tokens will be mined. The **iomob** Foundation (or **iomob** Technologies) will retain the freedom to dynamically define conversions, how many tokens are mined for them, eligibility for providers, and how they are split among participants. This is because these should follow from opportunities detected in the market.

Example strategies include activating token mining in particular geographical locations, such as the first major cities where an opportunity to grow **iomob** is detected or ongoing, or to reward existing mobility aggregators (or other players) that adopt **iomob** and contribute to its network effect.



Token Alocation - Growth Stage

4. Development Plan

Objectives and Deliverables

The main interest of the founders of **iomob** is to promote its adoption and growth. As a consequence, our development roadmap includes not only the implementation of the base infrastructure of **iomob** (that is, the **iomob** protocol and the smart contracts that lie at its core), but also to provide open source reference implementations of all the software components to be used by its participants who build businesses and infrastructure on top of **iomob**, including not only hubs, but also end-user and provider-facing applications, validators, etcetera.

By releasing all these software components under very permissive open source licenses, we will encourage independent teams to use them as a basis for their integration in the **iomob** network, either by further developing them as free or proprietary software, or simply by building and promoting rebranded versions. While we are aware that such software solutions could be adopted by competitors or fully centralized players alike, we expect free technology to be a driver for the growth of **iomob**, and, once it has established a global network effect, to minimize the incentives to build walled gardens in the mobility space.

In the long term, we will develop and release the following core pieces of the **iomob** stack:

- Specification of the **iomob** protocol
- ERC20-compatible token
- Smart contracts to regulate value exchanges in **iomob**
- Smart contracts that regulate mining
- Infrastructure to store feedback & reputation
- Mobility hub implementation

Then, in order to promote adoption, we will also release implementations of other components that sit atop the aforementioned core components of **iomob**:

- Customer-facing app to purchase mobility services
- Diver-facing ride hailing app
- Fleet management application
- Software stack for validators
- Software stack for payment processors
- Software stack for arbitrators

Short to Mid Term Roadmap

Development plans must adapt to changing conditions; it would be counterproductive to establish a rigid roadmap. Instead, our development plan revolves around early prototyping and short-lived development cycles, following the spirit of lean software development. Since **iomob** aims to form an ecosystem, we expect external actors to increasingly influence our development plans.

Accordingly, we will structure our efforts in short development cycles, starting with a prototype, the creation of an initial release with a reduced feature set (what software developers call a minimum viable product), and then iteratively improve and extend our releasesics

The advantage of such an approach is that 1) we accelerate learning and avoid committing to early design mistakes typically associated with a "waterfall" approach where an initial design drives a complete implementation rather inflexibly, and 2) the early releases can help partners visualize the advantages of **iomob** and engage in its design and development sooner, ultimately helping accelerate adoption and positively influence design decisions.

1. Genesis Prototype. Target: April 2018 (completed)
Develop a prototype including a barebones implementation of the protocol, a hub, and mock applications. This prototype is already under development, and will be used internally to further our understanding of how to approach the various challenges we will face while developing our technology. The prototype will feature a simulation of a synthetic city with taxis and a public transit network available to citizens, who can move around the city with such services or walking.

2. Simulation of a Real City. Target: June 2018 (completed)
Extend the prototype with data from a real city, including its network of streets and roads. Include a graphical front-end. This serves as a testbed of the **iomob** protocol and its various components, and will be the basis to extend the protocol and test software components.

3. Release 0.1 - MVP: Technology Preview. Target: November 2018
By the time of our Token Generation Event, we will have built the first version of our user-facing mobile app, as well as a first version of the **iomob** protocol, along with an implementation of a hub, validator, and an alpha version of the data marketplace. The hub will be prepared to operate on a major city, where it will be possible to discover mobility services, and for users to find the optimal routes towards by combining them. We will also launch our testnet as a PoA sidechain.

4. Release 0.2 - Launch: Service Booking. Target: Q2 2019
We will deliver a working protocol in a major city. Users will be able to use our end-user mobile app to discover and book mobility services on a hub that will have a trust relationship with a validator. Users and providers will be able to provide feedback on one another. The protocol will not, however, feature the integration of payments, which will be handled off-protocol (that is, via cash or credit card paid directly to the mobility provider). We will launch our production mainnet as a PoA sidechain bridged to the Ethereum network. All players, except for end-users, will be required to hold a minimum token balance to participate in the protocol. Mining rewards will be offered to incentivize the growth of the network.

5. Release 1.0: Feature-Complete Network. Target: Q4 2020
We will implement payments in the protocol, which is the last missing piece. Users will be able to pay with cash, credit card, or cryptocurrencies. The economic interactions we have described throughout this whitepaper will be fully in place, both with respect to payments between providers via our smart contracts, and the cryptoeconomic incentives for the growth of the network upon the delivery of verifiable mobility services. We will also provide an updated roadmap regarding decentralization and scalability, in accordance of the evolution of blockchain technology.

6. Beyond 1.0: Consolidation and Extension

We will progressively implement other forms of mobility, including bike sharing, car sharing and many others. We will progressively extend our hub tech to support all major cities of the world, and further integrate payments between providers. We will incentivize and promote the creation of validator services that cover all major cities. In this phase, business development activities and the success of our cryptoeconomic incentives and will drive our priorities. In this phase we will implement the scalability roadmap defined in release 1.0, and allow on-chain mechanisms to progressively take over the governance of the network.

5. Conclusions

We have presented the technical design of **iomob** as a decentralized architecture for mobility. **iomob** offers a level playing field for all mobility providers to offer their services in conjunction with partners, and for end-user front-ends to book such services. **iomob** allows providers to lend one another customers, and other players to specialize in particular roles, such as offering compliance validation, payment processing, or developing end-user apps. The **iomob** protocol allows these parties to effectively share revenues under spontaneous agreements that do not require trust among the parties. The cryptoeconomic design of **iomob** provides incentives for the sustained growth of the network.

We envision a world where **iomob** offers the basis for any mobility service all around the world, a vision which we call "Internet of Mobility". **iomob** is future proof, and supports not only current mobility

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