Mobilio Difficulty

Determining the Exchange Rate between Points and MOB Tokens

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1 Introduction

According to the WHO, traffic accidents are the leading cause of death for people aged 5-29 [World Health Organization, 2018]. The majority are caused by distraction, with smartphones playing a role in more than 26% of all car accidents, reported by the National Safety Council. With Mobilio, we want to motivate drivers to stop using their phones while driving and thus drastically reduce the number of accidents.

With the Mobilio app (available for Apple and Android smartphones) drivers collect points for distraction-free driving. These points can be exchanged for our cryptocurrency MOBILIO (MOB), an ERC-20 token on the Ethereum blockchain. The app also has a wallet so that users can transfer MOB to each other. Other market participants like insurance companies are free to accept MOB as a means of payment or to distribute them as a reward for good driving behavior.

This paper describes how hard it is for a user to get a MOB token. The effort is called *difficulty* and is defined as the number of points necessary to buy one token. While the tokens are generated linearly over time (a total of 50,000,000,000 over a period of 100 years), the number of points is linked to the number of users and the number of distraction-free minutes driven.

2 Token generation

So that the difficulty can be linked dynamically to the user behavior, we will generate a total amount of 50 billion MOB continuously over a period of 100 years. The continuous generation of tokens ensures that MOB are available for conversion, determined by the difficulty, throughout the 100 years after the first earned point. Initially, 5 billion MOB are transferred to the Dolphin account[1]. The remaining 45 billion MOB are generated over time, with c MOB tokens being generated per second[2]:

$$c = \frac{45\,000\,000\,000}{100 \cdot 365.24 \cdot 24 \cdot 3600} \approx 14.26003.$$

3 Difficulty

The difficulty is determined by the users' contribution to safer driving, as well as their participation in the purchase of MOB tokens: It is defined by the ratio between the total number of tokens available, and the number of points available for conversion across the system. It is calculated every 15 minutes, with the interval during which the difficulty is valid denoted by $I_t = [t; t+1), t \in \{0, 1, ..., T\}$. T denotes the number of 15-minute intervals during the period of 100 years, starting in 2019.

The number of convertible tokens is the difference between generated and claimed tokens. The number of convertible points within I_t is firstly defined by the number of earned, but not as yet converted points up to the beginning of I_t. In addition, all points earned within I_t can also be converted to MOB within I_t. To take those into account, we predict the driving behaviour within I_t based on a statistical time series model.

[1] Refer to our whitepaper [Trautsch, 2019] for a definition of accounts.

[2] There will be 24 leap-years between 2019 and 2119, resulting in an average of 365.24 days per year.

The value of an earned point is based on the ratio between the number of convertible tokens and the number of points in circulation. Having estimated the number of convertible points within I_t we then determine the number of available tokens during I_t. As was outlined in the beginning, we continually generate tokens so the number of generated tokens within I_t is $c \cdot 15 \cdot 60$. Tokens that were not converted in previous periods (up to the beginning of I_t) add to the number of newly generated tokens during I_t. Let the number of generated tokens up to the end of time interval I_t be defined by $C_t = \sum_{i=0}^{(t+1)} c \cdot 15 \cdot 60 = c \cdot (t+2) \cdot 15 \cdot 60$. Let y_t be the number of tokens converted within I_t. Transactions reduce the number of available tokens by a total number of $Y_t = \sum_{i=0}^{t-1} y_i$ tokens, thus the number of available tokens is calculated as $C_t - Y_t$.

If the predicted driving behavior underestimates actual behavior, it may be that more points are converted than anticipated. In this case, transfer to the wallets is delayed and our prediction algorithm intrinsically adapts the difficulty to an adequate level for recovery. At the same time, simulations show that overdrafts are extremely rare. Overdrafts that do occur tend to occur towards the early phases of operation, shortly after the system goes public, and before there are many users of the Mobilio App.

The conversion rate within I_t is the harmonic mean of all convertible tokens distributed on the estimated number of convertible points in circulation. It is driven by the number of users, the driving behavior, as well as the transaction speed:

$$\forall t \in \{1, 2, ..., T\} : q_{I_t} = \begin{cases} \frac{C_t - Y_t}{P_t + \hat{P}_t} & \text{if } Y_t \leq C_{t-1} \\ \\ \frac{15 \cdot 60 \cdot c}{P_t + \hat{P}_t} & \text{else} \end{cases} \tag{1}$$

At the start of the very first time period ($t = 0$), when the system first goes online, no points are available for conversion, and the difficulty is set to 0.

4 Simulation

Based on the travel time of users of our products, as well as their actual smartphone usage during trips, the number of points per user per time interval was estimated. A simulation of the proposed conversion rate (1) based on the observed driving behavior is shown in Fig. 1, assuming random conversion behavior. For simplification, the rate is shown on a daily scale covering a one-year period. The simulated increase in user numbers is shown in the top-left figure of Fig. 1; it follows a logistic growth process interrupted by a period with nearly stagnant user numbers.

The actual framework differs from the presented simulations due to the shortened interval on which the conversion rate is defined. Hourly data exhibits additional seasonal patterns (weekly as well as daily peak times), with their magnitude depending on the (cultural) homogeneity of the driving behavior. Besides, hourly data exhibits stronger volatility, which will interact with buying behavior. These patterns hold also for the specified 15-minute intervals. The pronounced volatility might be balanced by the buying behavior, leading to similar volatility as presented above. However, if the population of drivers is fairly homogeneous or if there are only a small number of miners, the influence of seasonal patterns as well as volatility will be more pronounced.

Over the first 80 days a small, slowly increasing number of users earns points[3] and randomly exchanges points for MOB. The conversion rate in this first phase declines quickly with each new user. The following phase of a near stagnation in user numbers (around day 120 to 180) also leads to a stabilization of the conversion rate[4] (bottom-right of Fig. 1). Finally, a steep incline in user numbers, as we might expect from a worldwide marketing campaign was simulated, followed again by a steady, yet slower increase in user numbers. From the bottom-right figure in Fig. 1 we see that a steep increase in user numbers leads to a steep decline of the conversion rate, meaning a steep increase in difficulty. However, as users increase, so will the market value of the tokens.

The oscillations of the difficulty apparent in all phases are due to variations in driving behavior. The simulated data is based on observed driving behavior of Austrian goSmart users, which exhibits pronounced weekly and seasonal patterns[5]. The worldwide launch

[3] The estimated number of points per user per day is based on real-life driving behavior.

[4] The level at which the difficulty stabilizes depends on the number of points that are available for conversion during each I_t. This in turn depends on the number of users, their driving and exchange behavior.

[5] The number of earned points for distraction-free driving is generally lower on weekends than working days, and lowest

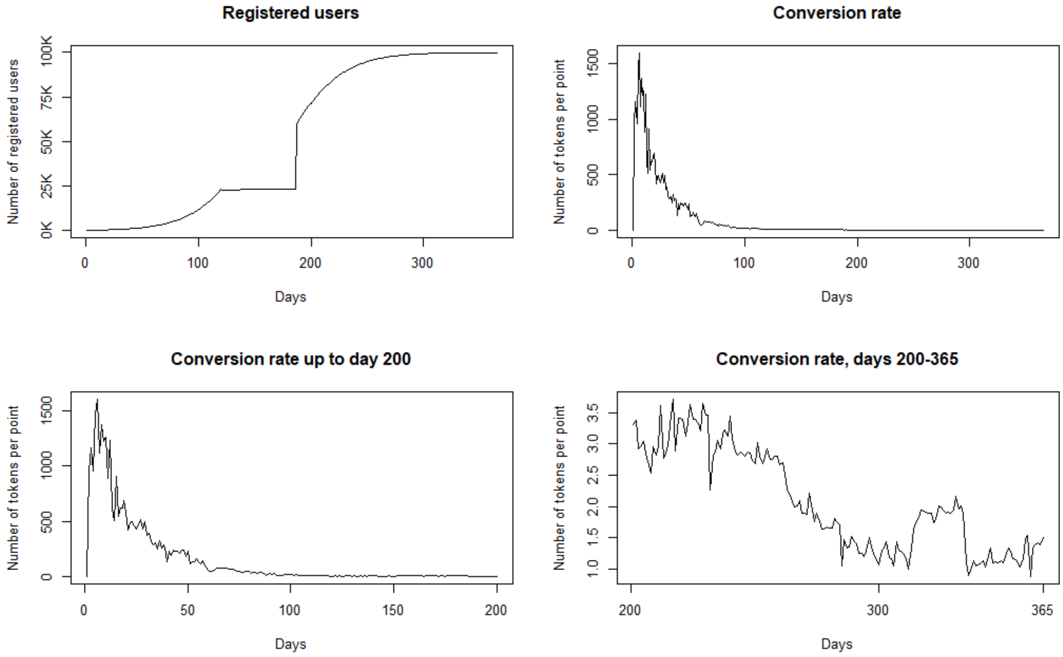

Figure 1: Top-left: Increase in user numbers following a logistic growth process. Topright: Conversion rate over the year. Bottom-left: Conversion rate up to day 100. Bottom-right: Conversion rate after day 100, with steep incline in user numbers (note change in scale). We assume random buying behavior during the whole year.

of Mobilio generates a heterogeneous user population that will dampen the seasonality. For example, the pronounced seasonal pattern we observe in Austria, especially the low driving frequency on Sundays and the holiday season, will be affected by users from countries where the timezone is different, where shops are open seven days a week, where a rest day is held on another day of the week, or where holiday season is at another time of the year.

How strong the driving behavior influences the conversion rate is determined by the buying behavior. The oscillations visible in Fig. 1 are pronounced as users sell points for MOB. This is not the case in Fig. 2. The simulated increase in user numbers is the same as in Fig. 1, but the buying behavior is changed. Here we assume that users earn, but don't convert their points to MOB until day 250. Because of this, the number of convertible points increases quickly, and thus the influence of newly earned points on the conversion rate is minimal. Therefore the oscillations induced by the seasonal differences in the rate are minimal. Even the steep incline in user numbers between days 170 and 200 does not result in an immediate fall of the conversion rate. On day 250, the conversion of all available points during the same 15-minutes time interval causes a sudden drop in the difficulty. After that, we again assume random buying behavior and reach the same difficulty level as was shown in Fig. 1.

on Sundays. The weekly differences are mainly caused by a lower driving activity on weekends, not by worse driving behavior. The Austrian goSmart users drive less on weekends and thus earn fewer points.

References

Harald Trautsch. *Mobilio - A Cryptocurrency Dividend for Safe Driving*. Vienna, 2019. URL `www.mobilio.cc`.

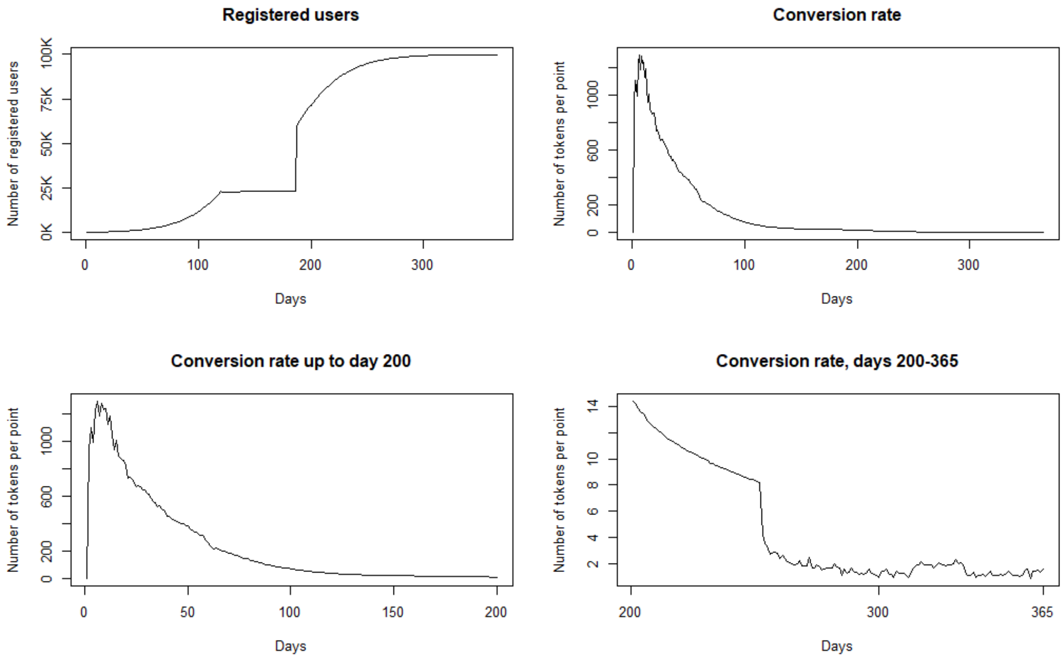

Figure 2: Top-left: Increase in user numbers. Top-right: Conversion rate over the whole time period. Bottom-left: Conversion rate where nobody buys tokens. Bottom-right: Conversion rate with steep incline in user numbers. There is no purchase until day 250, on which all convertible points are sold. After that, we assume random buying behavior again.

World Health Organization. *Global status report on road safety 2018*. Geneva, 2018. URL `www.who.int/violence{_}injury{_}prevention/road{_}safety{_}status/2018/en/`.