

Labcoin: Product Tracking and Authentication on the Blockchain

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Abstract. We propose a protocol that will cheaply and securely track product authenticity and provenance using a blockchain protocol and a utility token (Labcoin). Producers will attach Labcoin to their products, branding each unit as authentic. Labcoin will travel with these products through their supply chains, establishing a robust, low latency, digital chain of custody. Anyone can use Labdoor applications to scan Labcoin and verify whether a product is authentic and authorized for sale. Consumers earn Labcoin with every verified purchase, rewarding them for participating in Labdoor's network. Labcoin will also be used to incentivize the collection of accurate market data, including independent audits and user reviews.

1. Introduction

Counterfeit goods are a \$461 billion global industry¹. According to WHO estimates, 1 million people die annually after consuming fake pharmaceuticals². Increased public awareness of counterfeiting is part of the solution, but consumers must also have a way to accurately and trustlessly verify the authenticity of a product at the point of purchase. Pharmaceutical manufacturers are already building their own anti-counterfeiting solutions; however, these systems are always facing new attacks, requiring frequent overhauls³.

A global, open, decentralized network for product tracking and authentication on the blockchain can concentrate the efforts of market participants towards reducing the number of counterfeits sold and protect consumers from the dangers of consuming fake products. In this paper, we outline how we plan to build this network using a blockchain protocol and a utility token called Labcoin.

¹ OECD, EUIO, "Global trade in fake goods worth nearly half a trillion dollars a year," <http://www.oecd.org/industry/global-trade-in-fake-goods-worth-nearly-half-a-trillion-dollars-a-year.htm>, 2016.

² P. Behner, M. Hecht, F. Wahl, "Fighting counterfeit pharmaceuticals," <https://www.strategyand.pwc.com/reports/counterfeit-pharmaceuticals>, 2017.

³ J. Swiatek, "Eli Lilly intensifies efforts to stop fake pharmaceuticals," <https://www.indystar.com/story/money/2014/04/06/eli-lilly-intensifies-efforts-stop-fake-pharmaceuticals/7327471/>, 2014.

2. Labcoin Protocol

There are three main functions of this protocol:

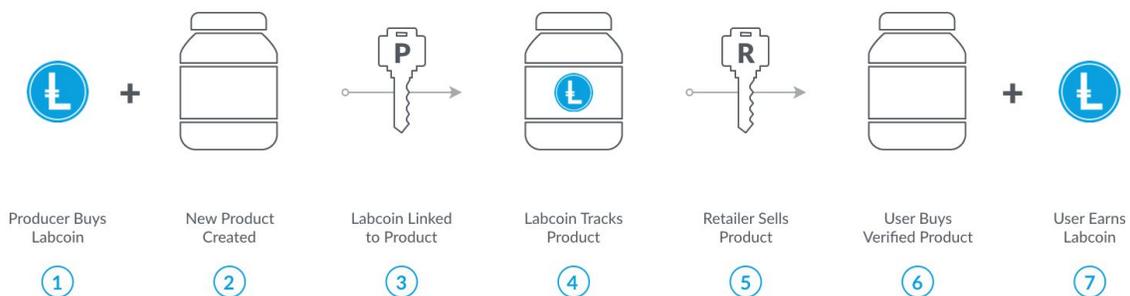
1. **Provable Ownership:** Producers use Labcoin to digitally sign each new unit, allowing anyone to rapidly verify the authenticity of a product.
2. **Chain of Custody:** Traceability is maintained at each transfer point in the value chain, tracking and securing products on their journey from producers to consumers.
3. **Decentralized Consensus:** Audits and validations can be performed at any layer of the supply chain by any party.

The cost of verification is key to the adoption of any supply chain protocol. Blockchain allows any market participant to cheaply verify product and transaction attributes at the unit level. This technology also allows units to be linked together into larger batches or lots, allowing distributors and retailers to efficiently track large transaction volumes without scanning every unit. At the end of the supply chain, consumers will be able to transparently access verified information on product authenticity and filter purchases based on required certifications.

3. Labcoin Token

3.1 Token Mechanism

Labcoin (LAB) is the native token of the Labdoor protocol. Labcoin will travel with products through their supply chains. Producers buy Labcoin and attach them to products with a timestamp and their digital signature. This links the digital and physical assets, directly connecting the value of product security to the sale of a product. All market participants will be able to transparently audit and validate products at any time. Producers or regulators will be able to send alerts to retailers and consumers when their products need to be recalled. When a consumer buys and verifies a product in the Labcoin network, they earn Labcoin, rewarding them for participating in the network.



3.2 Token Economics

As transaction volume increases against a relatively fixed token supply, token velocity increases. Token velocity is inversely related to token value, while token

staking is directly related to token value⁴. In the Labcoin network, token velocity is tied to production cycles. Once a token is staked to a product, it is locked up as it travels with the product through its supply chain. Consumers unlock this token value with each purchase. When consumers sell or spend Labcoin, the token becomes available for use in a new production cycle.

Network value is proportional to the transaction volume of Labcoin-activated products. Transaction volume increases as more producers adopt Labcoin and sell more Labcoin-activated products. This increases demand for Labcoin as producers need to buy more tokens to attach to their next batch of products. This consistent demand for Labcoin ensures a strong and growing value for Labcoin. It also helps maintain an equilibrium between token price and token velocity.

4. Labcoin Network

4.1 Ledger Layer

Trust minimization and cost reduction are the core requirements for the ledger layer of this protocol. Trust minimization is achieved through digital signatures and decentralized consensus on the authenticity and quality of products. Public keys confirm identification while private keys confirm ownership. Blockchain technology enables key product and transaction attributes to be digitally verified at costs under \$0.01 per unit, at least an order of magnitude cheaper than current solutions like RFID tracking and significantly more counterfeit-resistant versus certifications from standards organizations. A ledger will be maintained for LAB and will follow the ERC20 or ERC721 standard, providing a cheap and secure mechanism for tracking product and token ownership between network participants.

4.2 Market Layer

Consumers will be rewarded for participating in the network, receiving Labcoin by validating tokens, reviewing products, and referring new users and producers to Labdoor applications. Labdoor can also earn revenues by building and selling services on top of the network, including supply chain analytics for producers and retailers. Producers currently face high latency and large information gaps in their supply chain data. By establishing a robust, low latency, digital chain of custody, producers will be able to use our protocol and services to track and manage the distribution and sale of their products at the unit level.

5. Network Growth

5.1. Platform Development

It is important that this protocol quickly provides producers with a valuable utility independent of the consumer reward function. Most suppliers will be incentivized to wait for others to successfully implement this protocol before implementing it

⁴ E. Dhaliwal, "Why Token Velocity Matters," <https://hacked.com/token-velocity-matters/>, 2017.

themselves. We need to identify producers and retailers who are struggling the most with counterfeit products and recruit them to be our first verified suppliers. Part of our incentive budget will be reserved to fund pilot programs for these suppliers to test the value of our network.

5.2. Early Scale

Early users will receive bonus Labcoin for registering for Labdoor applications and referring new users. Bonus amounts will follow exponential decay functions to heavily weigh the incentives of the earliest participants. Token ownership will be incentivized by a proof of stake function that rewards users for holding tokens and staking them to confirm transactions. Labcoin holders will also maintain voting rights on changes to the Labcoin protocol, including the allocation of tokens to creators of new incentives and projects that will improve the network.

5.3. Critical Mass

Mainstream producers will only join the platform once a critical mass of consumers is actively demanding Labcoin and its connected product data⁵. Labcoin value will increase as its utility is proven in broader use cases, driving token demand. Higher token prices will also encourage wider participation in the product verification utility, giving mainstream consumers who usually don't care about product certifications a financial incentive to take action. This broad active participation also further secures the network.

6. Applications

Applications built on top of Labcoin's network have the potential to be more valuable than the network itself. Demand for these applications will drive demand for Labcoin, which incentivizes new application development. This flywheel will further link platform utility with network value.

6.1. Consumer Applications

Labdoor's mobile applications will be the easiest way to use, receive, and hold Labcoin. QR code scanning functionality will quickly connect consumers with relevant product data and certifications. When a user makes a verified purchase, they can collect their Labcoin reward through the same QR system. This application will also host each user's Labcoin Wallet, where users can stake Labcoin to participate in voting protocols or earn Labcoin for performing validations.

Every verified product scan will add to a user's personal product registry. This will help users precisely track the purchase and consumption of their packaged goods. This data will be valuable for self-improvement and could be shared with health providers to augment users' electronic medical records. Users could also set their

⁵ P. Oliver, G. Marwell, "A Theory of the Critical Mass," <https://www.ssc.wisc.edu/~oliver/PROTESTS/ArticleCopies/OliverMarwellCritMassI.pdf>, 1985.

preferences to highlight products that have earned key certifications or block the purchase of products known to contain specific allergens.

Consumers will be incentivized to write reviews of products they have consumed. Experts in specific product categories will be able to publish their rankings and recommendations, accumulating followers and Labcoin as their reviews gain popularity. These curated lists will drive awareness and engagement in the network, demonstrating the value of the information created by all participants.

6.2. Producer Applications

Producers could use Labcoin-based applications to automate supply chain analytics, regulatory compliance, and customer feedback, driving operational efficiency. Analytics applications that aggregate and visualize Labcoin activity data will offer producers precise visibility into their supply chains. Product sales will be traceable at the unit level with the ability to segment data by sales channel, time, and geography. Producers could also exert more decentralized control, remotely restricting which retail channels are authorized to sell their products. Supply chain failures such as product recalls could be rapidly broadcast to the products directly. Labcoin will serve as a digital customer rewards program that helps producers better understand and connect with their customers. Labcoin could also be used to facilitate smart contracts between producers and retailers, such as consignment agreements that automatically pay suppliers every time a product is sold.

6.3. Labcoin API

Labdoor will build and maintain an API to enable developers to build on top of the Labcoin protocol. Retailers could integrate Labcoin product data and reviews into its own applications to help their customers make informed purchasing decisions. Product images, instructions for use, ingredient lists, certifications, user reviews, and safety warnings could all be attached to a Labcoin-activated product unit, enabling interactive user experiences in-store and online. Retailers who integrate Labcoin into their payment systems could also be rewarded with bonus Labcoin to retain or distribute to customers.

7. Conclusion

We propose a blockchain-based network that will secure the digital identity of products. Producers will digitally sign each product unit, branding it as authentic. This utility is made possible by Labcoin, the native token of this protocol. Labcoin will travel with products through their supply chains, providing a digitally traceable chain of custody. Independent audits and user reviews can also be attached to products through this protocol. This enables anyone to verify product authenticity and quality without relying on a trusted third party. Labcoin will link the value of product security to the sale of products, driving ownership and activity in our token economy. This protocol should also limit the need for trusted third parties, with automation at the center of the network and humans at the edges.

This protocol aligns incentives between all network participants:

1. Consumers earn rewards for performing verifications and purchasing verified products. The verification step provides valuable information to the network and requires active participation to gain value from the network.
2. Producers who implement Labdoor's protocol will receive increased supply chain visibility and decentralized control over distribution. Labcoin's reward function also connects producers to consumers directly, allowing information and value to flow in both directions.
3. Labdoor can sell tokens to fund platform development, distribute tokens to reward contributors to the network, and retain tokens to align company value with network value.