

Business White paper

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AnyLedger Introduction and Executive Summary

AnyLedger connects the physical world to the blockchain by building an embedded wallet for the Internet of Things (IoT). Every device will be able to execute transactions and interact with the blockchain. Companies with no prior blockchain expertise can use AnyLedger platform to craft a secure IoT infrastructure, powered by any kind of blockchain.

The AnyLedger architecture is end-to-end, starting from the hardware device and the embedded software, and going up to the remote management of the devices and the blockchain nodes. The AnyLedger platform is the first IoT-Blockchain application enablement platform, featuring capabilities such as instantaneous switching between different blockchains by simply updating the devices over-the-air, decentralized access control based on smart contracts, blockchain based device lifecycle management, decentralized storage for IoT and deployment of multiple blockchains on the same IoT device. AnyLedger is particularly focused on very small energy footprint devices, which will dominate the IoT in the coming years.

AnyLedger has a double role as enabling technology: firstly it will allow quick development of blockchain applications into the physical world. Secondly it will pave the way for the new IoT architectures which will be resilient, decentralized and autonomous thanks to blockchain technologies.

The Energy (ENE) token is used by humans and devices to access the AnyLedger platform in a decentralized fashion. The token will be issued to the public partly in a sale event and partly over the years in form of bounties and airdrops for the development or usage of the platform.

Which problem are we solving

Traditional physical assets are not able to exchange value and interact with humans and other assets. Fundamentally, physical objects are missing an identity mechanism able to connect them to the digital world. The IoT is part of the solution, since Internet connected devices are able to create the above mentioned link between physical and digital. The other half of the solution is the blockchain.

The blockchain has an answer for (nearly) every of the IoT issues. The public-private asymmetric cryptography, paired with a secure hardware device, takes care of the identity problem. The tamper-proof register of transactions and states can harden the device integrity and resilience to attacks. The decentralized nature of the blockchain allow for an IoT architecture without single points of failure, vendor lock in and privacy concerns.

Apart for being a big enanchement for the IoT, the blockchain has attractive applications in the physical world. Interesting examples include building decentralized and tamper proof ledger for a product supply chain, securing the communications of connected vehicles and creating peer to peer marketplaces (data, energy, utilities for instance).

A plethora of startups are rushing into these opportunities, building vertical applications and all the technological stack required. Some of them are even building ad hoc blockchains for this. This approach does not scale to a mature market, in which application and infrastructure layers are clearly separated. It is estimated that the cost of building the entire stack for large fleets over a period of 5 years can be up to 100 times more expensive than just outsourcing and focusing on the application.

AnyLedger is building the infrastructure layer between IoT devices and blockchains

, which at the moment is lacking for generic applications. For very small footprint embedded devices, the future of IoT, the situation is even worse, nearly nothing is there.

Companies using AnyLedger can focus on the use case, without worrying about the underlying complexity, forgetting that they are using blockchain technology. AnyLedger is the missing piece between a pre chasm and a mature market.

Why AnyLedger is needed and why it is the right solution

The blockchain is a very immature technology. The IoT is more mature in comparison, even though it still suffers from high fragmentation and lack of real standards. Every solution targeting the intersection of IoT and blockchain must be extremely flexible especially on the blockchain side, since nobody knows which blockchain will be best suited for a specific IoT application. That is why

AnyLedger is built to be blockchain agnostic: any present and future blockchain can be supported, with the same architecture, and switching between one and another is as simple as updating the fleet of devices over-the-air.

That where the name AnyLedger comes from. AnyLedger therefore solves one of the main adoption obstacles for the blockchain in IoT, the fear of being stuck with a sub optimal technology, which undermined the IoT-Blockchain growth so far.

While other projects are bringing the blockchain to small computers like Raspberry Pie or similar, the future of IoT lies in the very low footprint sensors and microcontrollers. AnyLedger focus on this, at the moment nearly unexplored, territory.

Being very low footprint, the AnyLedger stack can be installed easily on existing devices as a software extension. In this way, every IoT device inherit all the basic blockchain capabilities. Notice that it's not important which connectivity the device is using. This makes AnyLedger technology extremely flexible and attractive to existing markets.

AnyLedger is also built to solve two big pain of the IoT market: vendor lock in and end-to-end solutions. Firstly, tech giants try to lock IoT users into silos and to make the switch between different providers extremely cumbersome. This happens particularly since the data is stored in centralized cloud containers. AnyLedger gives the possibility to interact with decentralized storage solutions and cloud services, therefore AnyLedger users are never locked in. This solution is perfect for companies which value their data and don't want to lose control over them. Secondly, AnyLedger as a platform is built to be end-to-end, making simple for companies with no tech expertise and workforce to employ IoT-blockchain solutions.

Very High Level Technical Architecture

For an in depth explanation of the AnyLedger architecture we demand the reader to the technical white paper. Here we will limit to outline the main points.

The overall architecture includes a custom secure hardware component, the firmware running on the IoT device, a backend component running in the cloud to connect the device to the remote blockchain nodes, one or more blockchains, a wallet fleet management and access to decentralized storage.

At a technical level, AnyLedger greatest innovation and main value proposition is transforming every connected device into a blockchain hardware wallet.

More in detail, the IoT device can install a small footprint software extension which make it able to store, generate and manage private keys in a secure manner. This open source firmware component is the core of AnyLedger. It represent a collection of embedded blockchain wallets and very light real time operating system which also takes care of the device lifecycle management. A particularly relevant feature is the possibility of updating the devices over-the-air.

Since the keys are generated on the devices themselves, every is device is autonomous and AnyLedger has no control over them. AnyLedger solves the problem of power constrained devices by connecting them to remotely hosted nodes. The fact that devices are completely autonomous entities opens up interesting scenarios in connection with smart (Artificial Intelligence powered) devices.

The wallet fleet management is the layer seen by the end user. It allow to remotely control the fleet of devices leveraging blockchain smart contracts for access control and firmware and data integrity checks. It also feature access to decentralized storage (such as IPFS) and additional services like analytics.

The hardware component is a very small printed circuit board which can be integrated by IoT manufacturers in their devices. Instead of immediately developing this component, AnyLedger will start by focusing on supporting existing hardware components with sufficient security requirements which are already available on the market.

Product Road Map

- **April 2018:**
 - Embedded wallet prototype in Ethereum.
- **September 2018:**
 - Second iteration of Ethereum prototype, with industry and security ready hardware. Including AnyLedger Hub and wallet management.
- **Jan 2019:**
 - Embedded wallet prototype in HyperLedger
 - MVP in Ethereum.
- **Q2 2019:**
 - Blockchain Digital Twin feature implemented.
 - MVP in HyperLedger
 - PoC in Ethereum with big size industry partner
- **Q3 2019:**
 - Decentralized access control feature implemented.
 - PoC in HyperLedger with big size industry partner
 - Embedded wallet prototype with third and fourth blockchain
- **Q4 2019**
 - PoC with large fleet of devices
 - MVP in third and fourth blockchain
- **H1 2020:**
 - Industry Level Platform for Ethereum and HyperLedger
 - Design and first iteration of hardware component.
 - Embedded wallet prototype for all the major blockchains and industry favourites.
- **H2 2020:**
 - Hardware component ready.
 - Industry Level Platform for selected additional blockchain
- **2021:**
 - End-to-end (hardware to management) industry level IoT-blockchain platform.
- **2022:**
 - Expand to deliver fully integrated IoT-blockchain solutions (B2C) for selected industry verticals.

Example Use Cases

For the existing markets, we see at least four different waves of innovations that AnyLedger can empower in the near future:

-Supply Chain and Logistics

Blockchain can be used in the supply chain industry and logistic, particularly for international trades. Smart sensors running AnyLedger would be able to automatically record the entire history of every shipment on the blockchain and execute Smart Contract that sender and receiver agreed upon at the beginning of the shipment. Logistic companies can choose to be automatically paid with currency put in escrow inside a Smart Contract and unlocked after confirmation of delivery. In exchange, they attract new customers and get discounted tariffs from insurance companies. Goods would be monitored from the production plants to the small shops, giving a complete history (provenance) of the product to the end customer.

-Payment Systems and Sharing economy

Enabling payments for every physical object will create new business models. Imagine decentralized marketplaces in which sensor owners are getting paid to share their collected data or objects paying fees just once entering geo-fenced areas.

These technologies will also bring the sharing economy to new levels. Bikes and cars will become available to be shared everywhere inside the city, industrial machinery and tools such as 3D printers and construction equipment will be rented according to the time usage. Previously, the sharing economy was powered by centralized solutions big enough to build their own payment networks. The future sharing economy will use a peer-to-peer model since it will become easy to for objects to exchange financial value.

-Machine-to-machine communication

Fast machine-to-machine communication allows easy sharing of data and value for interactive applications. Electricity can be distributed by smart grids and be able to create a dynamic decentralized marketplaces between energy producer and consumers. Self-driving cars will communicate securely between each other and would be able to automatically pay tolls, parking and fuel. Smart traffic systems will be enabled to decrease the traffic real time by incentivizing cars to run across roads with less pollution, traffic and noise. Smart factories, also known as Industry 4.0, and smart homes will be finally a reality.

-IoT Security

Some connected devices require very high standard of security, either because they are very expensive, potentially dangerous or life-critical. Examples are industrial machinery and medical devices. AnyLedger leverages the blockchain to assure

firmware integrity, device authentication, tamper proof over-the-air updates and device lifecycle management.

Another interesting opportunity is the birth of a truly decentralized IoT. We can imagine IoT devices autonomously paying the computing power and memory storage that remote cloud-services, connected themselves through the blockchain, can remotely offer. Interesting projects in this direction are Golem and Filecoin.

Finally, it is worth remembering that the majority of world physical assets, worth hundreds of trillion dollars, are not tradable right now. The blockchain could allow the tokenization of all these assets, allowing seamless exchange of value and goods, without the need of a trusted third party. This usage will be particularly powerful in areas like real estate and art.

The most exciting applications of AnyLedger are the ones that we cannot even fully grasp at moment.

The AnyLedger embedded wallet will be built to be open source and we are confident that the community of developers and makers will figure out the next big thing.

Business Model

AnyLedger is an open source project. Indeed a very big part of our tokens will be allocated during the years to incentivize developers from all over the world to contribute. The software and the hardware will be available for everybody to share, modify and build on top.

AnyLedger itself will provide, on top of this stack, a layer of additional services, which can be accessed using the ENE token. This blockchain-as-a-service for Internet of Things can be used by all the companies and service providers which are not willing to personally host the AnyLedger architecture with their resources.

AnyLedger blockchain-as-a-service makes the deployment of IoT-blockchain applications completely effortless for these companies.

This offering can be compared to how companies use external cloud providers to outsource their computational and storage needs, with the difference that the AnyLedger architecture is decentralized, therefore data is never locked in.

Market Size Estimate

In this section we will briefly estimate the total addressable market that AnyLedger is going to touch. Even though we believe that “market size” is not the right measure for a disruptive technology with deep cultural and social implications, we nevertheless understand that this language is familiar to the public, particularly in relation to the participation in the public sale.

The number of installed IoT at the moment is staggering, with the most renowned consulting firms estimating this number at 12 billions devices. On top of this, the IoT has just started its accelerated expansion, with a very aggressive estimated CAGR between 20 and 30%. For 2020 the estimate is of 20 billion devices and in 2030 this number can skyrocket to 120 billion.

The estimates for 2020 of the whole IoT market size is around 3 Trillion dollars (Gartner), of which slightly more than half is B2B, the main focus of AnyLedger.

We believe that once blockchain technology is mature enough, every single IoT device will benefit from becoming a blockchain hardware wallet.

The IoT market size, can be divided into the different layers of the technical stack. In particular one can identify the layers of identity, security, core infrastructure, applications, services, analytics, communication and hardware.

The core offerings of AnyLedger include identity, security, core infrastructure, services, summing up to around 40% of the market size. Applications, hardware and analytics are also marginally or indirectly touched by the AnyLedger platform.

AnyLedger will firstly approach the market as a pure software solution, usable on a large number of supported hardware boards and chips. The first wave of adoption will be driven by PoC industry partners and open source enthusiasts. The platform nature of AnyLedger makes the software easy to try, and to spread the software AnyLedger will incentivize early adopters with token airdrops. AnyLedger will partner with selected IoT application enablement platforms, which lack blockchain capabilities, to deliver a fully IoT-blockchain solution, therefore leveraging the existing customer base of the partners.

A second phase will see the manufacturing of a very small custom hardware component, making AnyLedger able to talk directly to IoT manufacturers, which can insert this hardware extension to give blockchain capabilities to the device. A close connection with IoT system integrators will allow AnyLedger to offer custom solutions for particularly interesting industry verticals.

Token Economics

Token Overview

The AnyLedger platform is supported by the **Energy Token** (ENE), which is needed to enjoy the full blockchain-as-a-service functionalities of AnyLedger. In particular, every IoT device can be in different states according to the amount of ENE being sent to the device. The token is designed with the intent of aligning the interest of token holders and users of the platform, in agreement with the basic principles of mechanism design.

These base configurations are:

- **Not Powered**

This is a device that has not been onboarded yet. In this configuration, the IoT device has very limited access to the functionalities of AnyLedger Hub.

- **Charged**

The IoT device has been provisioned by the AnyLedger Wallet Fleet Manager. The IoT device has access to AnyLedger Hub with nearly full capabilities, but the fleet management is available just for small fleets. Also the technical support and access to cloud storage are limited.

- **Super Charged**

The IoT device has been topped up with enough ENE tokens, starting from a Charged state. The IoT device has access to AnyLedger Hub with full capabilities, enhanced support and can be part of a fleet of unlimited size.

The exact relation between states and available features can be found in the table shown below.

Devices are Charged by default once onboarded by the AnyLedger Wallet Fleet Manager. AnyLedger reserves a significant part of the token allocations to airdrop tokens to devices which onboard (hardware/firmware airdrop). The tokens are sent to an address owned by the device itself, as an authentication confirmation. A small part of these tokens are burned by the device to activate the Charged state. The devices can later use the remaining tokens at will, for instance to upgrade to a Super Charged state.

The activation of the Super Charged state requires a certain amount of ENE tokens sent to AnyLedger. We stress that after the owner of the device, or the devices itself, send the ENE tokens, AnyLedger will send a small amount of tokens to the device to be burned. Therefore, on the blockchain there is an immutable proof certifying that

the device is legitimate and has the right to access the associate benefits. Notice the double role of the ENE token as an authentication mechanism and utility token to access the AnyLedger services.

The majority of tokens will be release through a TDE (Token Distribution Event) and in the hardware/firmware airdrop, while the remaining part are used to bootstrap the project, incentivise the developers and the rest of the team, reward external contribution to the platform. The next section will outline in detail the token allocation.

The hardware/firmware airdrop is triggered when acquiring the hardware from AnyLedger or onboarding a device using AnyLedger Wallet Fleet Manager.

The community contribution token allocation is particularly substantial and is divided into these subcategories:

- Bug Bounties
Reports of security breaches or opening relevant issues in platforms such as GitHub.
- Developer Bounties
Contributions to the source code in platforms such as GitHub and open source projects beneficial to the AnyLedger community, for example wallet implementations of blockchains which are not already supported.
- Community Project Grants

There are four kind of grants supported by AnyLedger in the IoT-blockchain space:

- (1) Startups using IoT and blockchain in innovative ways
- (2) Research papers and proof of concepts
- (3) Hackathons, events and conferences
- (4) Platform promotion

The ENE token adheres to the ERC20 token standard and has fixed supply of one trillion tokens, that is 10^{12} . Regarding token burns, this feature is in place to align the interests of token holders and users of the platform, thereby limiting speculation: ENE is a utility token and its value with respect to FIAT or cryptocurrencies is directly related to the usage of the platform. With a similar end goal a staking mechanism is introduced, in which holders are rewarded for their commitment. The next section will illustrate details on available actions to access the platform, burning and staking.

AnyLedger Hub Features	Not Charged	Charged	Super Charged
Onboarding	×	✓	✓
Topping up wallet	✓	✓	✓
Authenticated firmware updates	✓	✓	✓
Connection to blockchain	✓	✓	✓
Access Control	×	×	✓
Remotely disconnecting devices	×	✓	✓
Remotely wiping off devices	×	✓	✓
IPFS access	×	×	✓
Enable/disable feature remotely	×	×	✓
Basic support	×	✓	✓
Advanced support	×	×	✓
Analytics	×	✓	✓
Multisignature	×	✓	✓
Fleet size > 200	×	×	✓

Token Economy Details

In this section we will give a lists of actions available to token holders.

- Onboarding a device:

Onboarding the device will trigger the hardware/firmware airdrop: an amount of tokens equal to $D_H\%$ dollar cost of the hardware is sent, or a fixed amount $D_F\%$ if the firmware is installed. These and other parameters are set at the end of this section. A fixed number B_0 of the tokens is burned. Notice that this number is not dependent on the FIAT value of the token (but there will be a FIAT threshold T , to not make the burning unsustainable for platform users. For instance, with $T = 0.1$ Euro, if the token is worth more than 10 cent, then just a fractional amount of token equal to 10 cent is burned).

- Time based Subscription:

Time based Subscription for Supercharging can be paid in tokens. The price is in FIAT amount, so that is only the price in tokens that will fluctuate. Buying the service with tokens grants a $D_1\%$ discount with respect to FIAT. If the wallet doing the transaction was holding the tokens for a certain period of time, the amount of discount increases to $D_2\%$ (this reduces the token volatility and in turn leads to a better token price and alignment between platform users and token holders).

A fixed number B_1 of the tokens is burned every period P .

If the payment is done in FIAT, AnyLedger will buy the tokens required for the burn from the open market.

- Usage based Subscription:

Usage based Subscription for Supercharging can be paid in tokens. Same as before, but the cost is billed for every single call to the API. The parameters here are D_3, D_4, B_2 .

$$D_H = 50$$

$D_F =$ time dependent, capped by a FIAT threshold.

$$B_0 = 100$$

$$D_1 = 3$$

$D_2 =$ time dependent, capped at 17

$$B_1 = 10$$

$$P = 1 \text{ day}$$

$$D_3 = 3$$

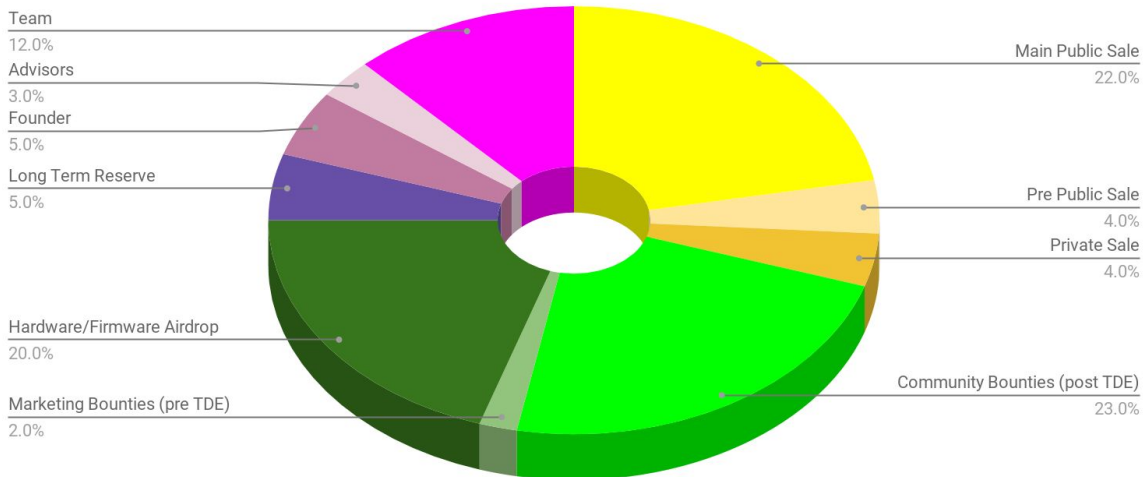
$D_4 =$ time dependent, capped at 17

$$B_2 = 10$$

In the scenario in which a substantial amount of the tokens have been burned, the amount needed for being charged or supercharged will be adjusted so that a single token will be able to power more than one device. AnyLedger will reserve to introduce new functionalities and actions, according to the feedback coming from the community and the industry.

Token Distribution Event (TDE) Details

Token Allocation



22% main public sale

4% public pre sale

4% private sale

23% bounties, promotion and grants (to be used after TDE)

2% bounty program (marketing, to be used before TDE)

20% hardware/firmware airdrop

5% company long term reserve (1 year cliff 5 year vesting)

5% founder 1 year cliff (from TDE) 3 year vesting

3% advisors 3 months cliff (from TDE) 2 year vesting

12% team 1 year cliff (from TDE) 3 year vesting