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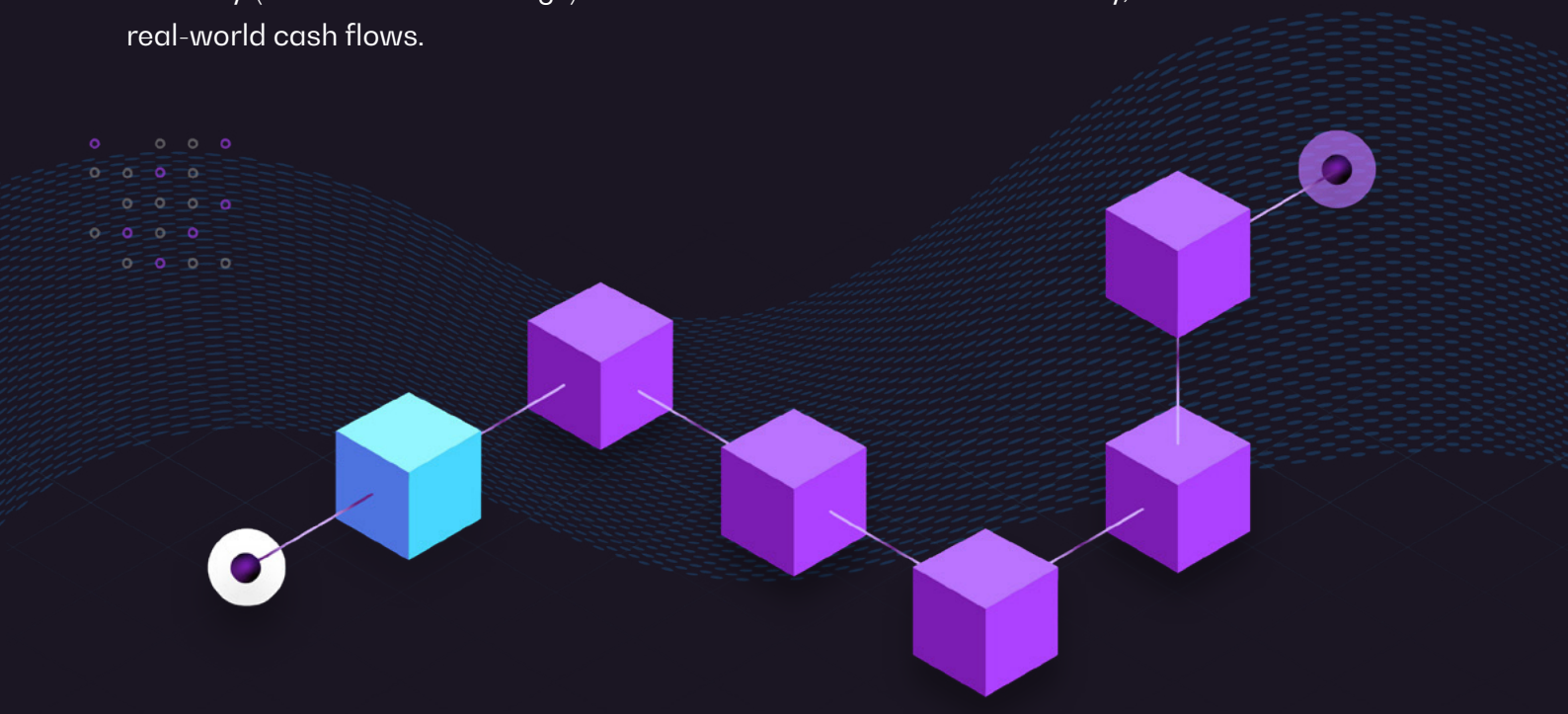
Energy Web Decentralized Service Level Assurance Light Paper

How $EWT, DIDs, and dSLA power the clean energy transition

November 2021

Executive summary

- Staking is essential to our decentralized service-level assurance (dSLA) platform. It allows for decentralized, community-driven curation and quality control of service providers.
- dSLA is a way for the Energy Web community to ensure our open-source solutions are delivered flawlessly and to give our enterprise customers the assurance and convenience they expect.
- Staking rewards on dSLA come from value created in the real world (as opposed to inflationary rewards paid in newly minted tokens).
- dSLA rewards are distributed only to high-performing Providers and the Patrons who support them. This way, the end-users of the platform can trust the quality of services they receive, without the need to trust an individual Service Provider.
- We estimate that by 2030, between 200 million and 1.2 billion decentralized identifiers (DIDs) will use Utility Layer services delivered through the dSLA platform, inclusive of both devices and users.
- Energy Web Token ($EWT) is the fuel on which dSLA runs. $EWT will be the first and only (to our best knowledge) blockchain token with real-world utility, tied to real-world cash flows.



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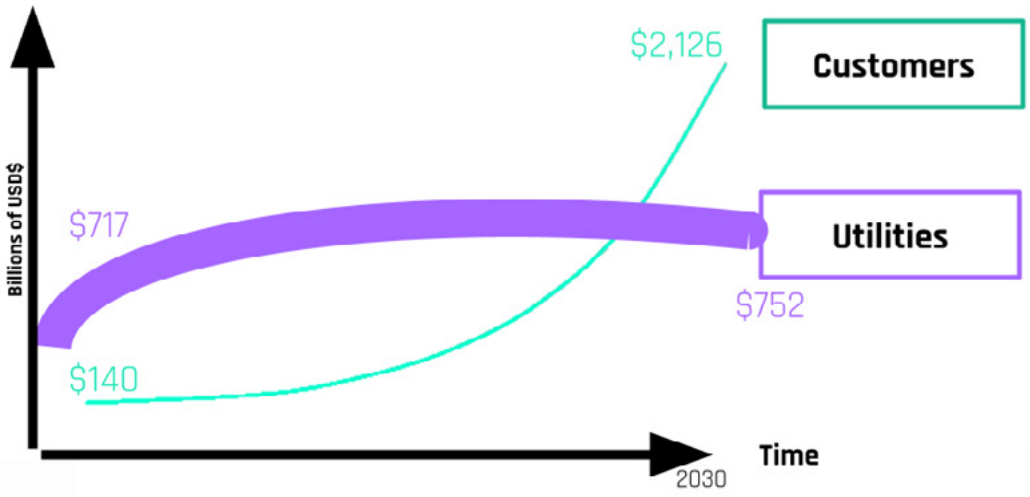
Introduction

THE GLOBAL CLEAN ENERGY TRANSFORMATION

The world's electricity grids are undergoing a fundamental transformation. A century-old legacy of large, fossil-fueled power plants as the backbone of centralized power grids is giving way to a revolution of emissions-free distributed energy resources (DERs) that collectively sustain increasingly decentralized power grids.

Such DERs include technologies such as electric vehicles (EVs) and EV charge points, smart thermostats, solar PV inverters, wind turbines, grid-interactive water heaters, and smart meters. These assets are in the midst of a massive proliferation. Based on Energy Web analysis of Bloomberg New Energy Finance and RMI forecasts, we expect the total number of installed devices to grow from 2.2 billion in 2022 to 3.8 billion by 2030. That's nearly 1 device for every 2 people on the planet.

Just as revolutionary is who is investing in these technologies: customers. From homeowners to EV drivers to companies, customer spending on clean energy technologies alone is forecasted to eclipse utility spending on *all* energy.



DIDs

ANCHORING A NEW DIGITAL OPERATING SYSTEM FOR POWER GRIDS

Amidst this mega trend, the biggest blocker in decarbonizing the electric grid is the lack of connectivity and shared standards across billions of distributed low-carbon devices, not the lack of new renewable energy resources. The existing and new clean energy assets are not integrated with market participant operating systems.

> **modern grids need an identity and access management solution tailored for the sheer volume and diversity of clean energy resources in the market**

The energy sector needs a secure, scalable way to identify the growing number of clean energy resources, verify attributes about them (like location, capabilities, and financial relationships), and manage permissions and/or behaviors based on those attributes. In other words, modern grids need an identity and access management solution tailored for the sheer volume and diversity of clean energy resources in the market.

Legacy approaches are not up to the task; it's simply not feasible for any single company or platform to manage everything, and relying on point-to-point integrations between individual systems is too costly and complex to manage at scale. Instead, decentralized, open-source digital infrastructure makes it possible for customer-owned assets to enroll and participate in coordinated grid operator programs.

This is exactly what we are building with the Energy Web tech stack, also known as the Energy Web Decentralized Operating System (EW-DOS). A core component of the tech stack is decentralized identifiers (DIDs).

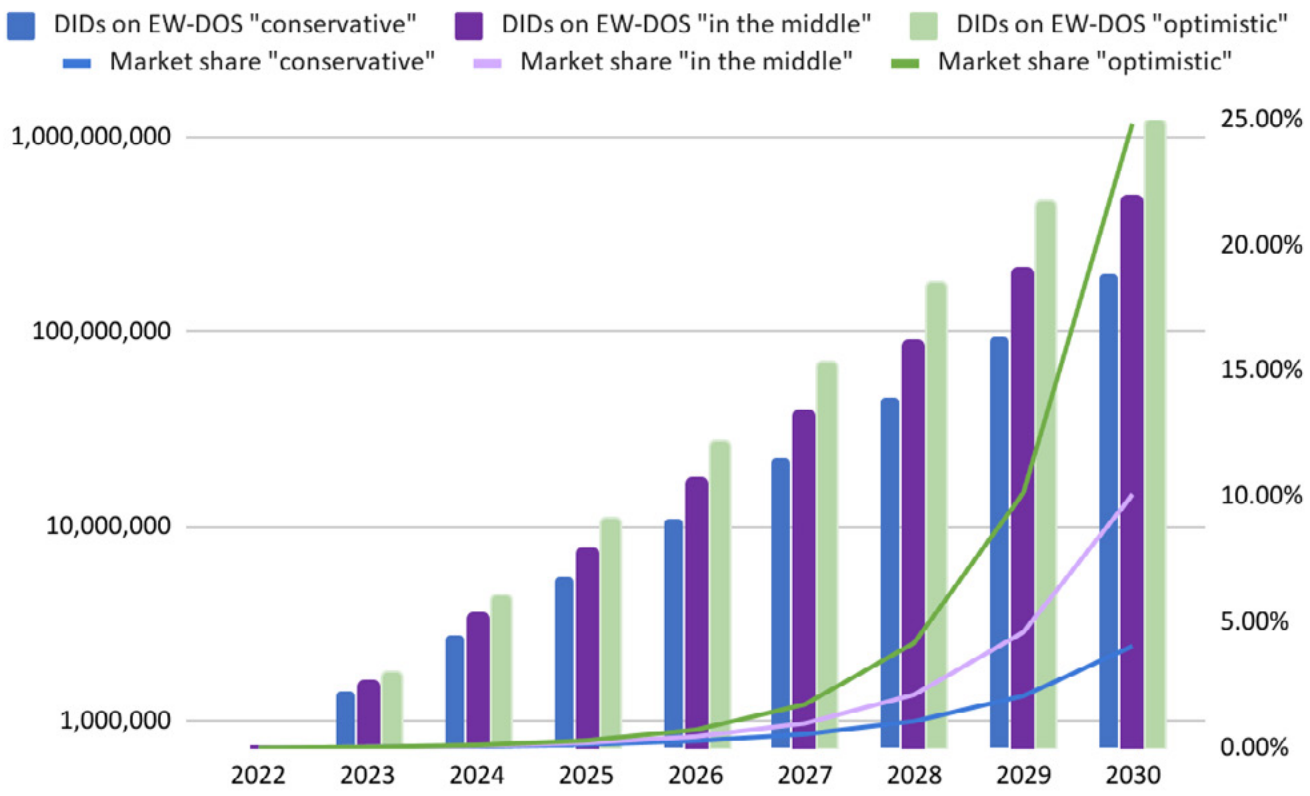
> **we estimate that by 2030 there can be between 200 million and 1.2 billion DIDs using the Energy Web tech stack. Roughly 4 out of every 5 DIDs (83%) will belong to energy assets like EVs, solar PV systems, and smart meters. The balance (about 17%) will belong to the people and companies that own and interact with these assets**

A DID is a digital, verifiable identity that is user-generated and not coupled to any centralized institution. It can be used to identify any object or subject, such as a person, an organization, a device (e.g., an electric vehicle or a smart meter), and non-tangible assets (like contracts). DIDs allow users to have control over both their identities and any data associated with them.

Instead of a central entity being in charge of issuing identities and verifying credentials for each identity, any individual or asset can create an identity, and then establish verified credentials over time through interactions with peers or authorities on a trusted, decentralized network.

A DID resides in a DID registry, which in the case of Energy Web, is on the Energy Web Chain. Because Energy Web DID technology is developed based on the established W3C standards, it is flexible enough to work with any technology and use case within the energy sector and outside it.

With billions of customer-owned DER devices being added to the world's power grids in the years just ahead, we estimate that by 2030 there can be between 200 million and 1.2 billion DIDs using the Energy Web tech stack. Roughly 4 out of every 5 DIDs (83%) will belong to energy assets like EVs, solar PV systems, and smart meters. The balance (about 17%) will belong to the people and companies that own and interact with these assets.



DID ADOPTION ALREADY TAKING OFF IN TWO OF THE WORLD'S LARGEST ELECTRICITY MARKETS

This future of DIDs as the anchor for a new digital operating system for power grids and the markets behind them is already becoming a reality today. During 2021, we announced major deployments in partnership with two of the world's largest electricity markets: California and Australia.

First, the California Independent System Operator (CAISO) is responsible for managing the transmission grid across much of California and a small part of Nevada, serving about 32 million customers. Their Flex Alert system communicates a call to conserve electricity during specific critical hours, such as when demand is surging from high air conditioning electricity needs during a heat wave. That communication takes several forms, including an email to Flex Alert subscribers and posts to social media. Now those Flex Alerts—and all the customers and devices that respond—can be anchored to individual DIDs.

Meanwhile, Australia is a Top 15 emitter of greenhouse gases globally. It has a history of coal-fired power. But today, it also has one of the highest penetrations globally of low-carbon DERs such as rooftop solar panels and home batteries. Australia's National Electricity Market (NEM) is at the bleeding edge of the distributed energy world, and it's only getting more advanced in the coming years. With the highest per-capita penetration of solar PV in the world, an incredibly mature storage market, a host of EV incentives, and greatly expanded opportunities for demand-side market participation, Australia is on pace to get nearly half of its electricity from DERs by 2040. Now, the Australian Energy Market Operator (AEMO) has launched Project EDGE on the EW tech stack. In EDGE (Energy Demand and Generation Exchange), all participating organizations and DER assets are given a unique DID.

This DID architecture of the Energy Web tech stack also underpins our work with grid operators such as Electra Caldense (Spain), Elia Group (Belgium and Germany), and Austrian Power Grid.

Decentralized Service-Level Agreements (dSLAs)

UTILITY LAYER SERVICES AS THE *MACHINERY* FOR DIDS

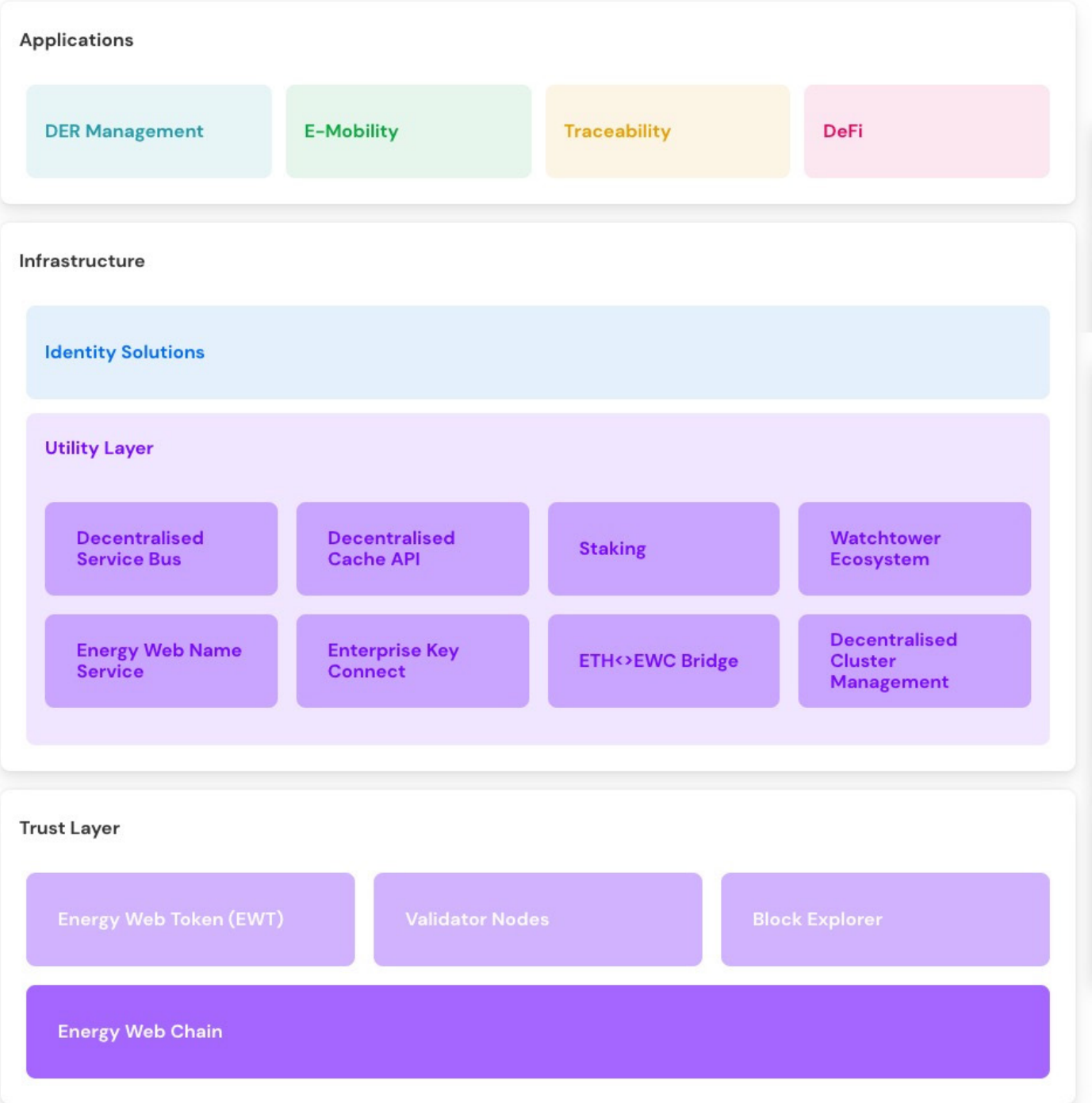
Energy Web DIDs are created and controlled by users. They are free to use and open source. Anyone can use our entire DID tech stack and the Energy Web Chain without paying for it, except for the blockchain transaction (gas) fees. This would be the equivalent of launching a website on your own server and using free, open-source technologies like Linux, MySQL, and WordPress. It's perfectly possible, but people and companies rarely do it, because this approach is inconvenient and cumbersome. It takes a lot of effort to launch a website like this, and it takes a lot of effort to maintain it. In the end, this approach tends to be quite expensive after considering all the time, effort, and associated risks.

> **there is a robust dSLA-supported market for Utility Layer services on the Energy Web tech stack**

What usually happens is users buy services from specialized providers. In the website example, users can buy pre-configured virtual servers from a cloud provider like Amazon Web Services or Azure or decide to buy a managed website service from a website builder like Wix or Squarespace. These services come with a service-level agreement (SLA) that guarantees the level of service users can expect, such as website uptime, storage space, or the number of CPU cores. Users pay for convenience and reliability delivered by the specialized service providers because after considering all the costs and risks, this tends to be a cheaper solution.

At Energy Web, we understand that in order to have any meaningful adoption of enterprise applications using decentralized digital technology, a DID-based tech stack has to be offered in a convenient and reliable way as well. This is why we're developing the decentralized service-level agreement (dSLA) solution. With this solution, users will be able to subscribe to professional-grade services delivered by specialized service providers.

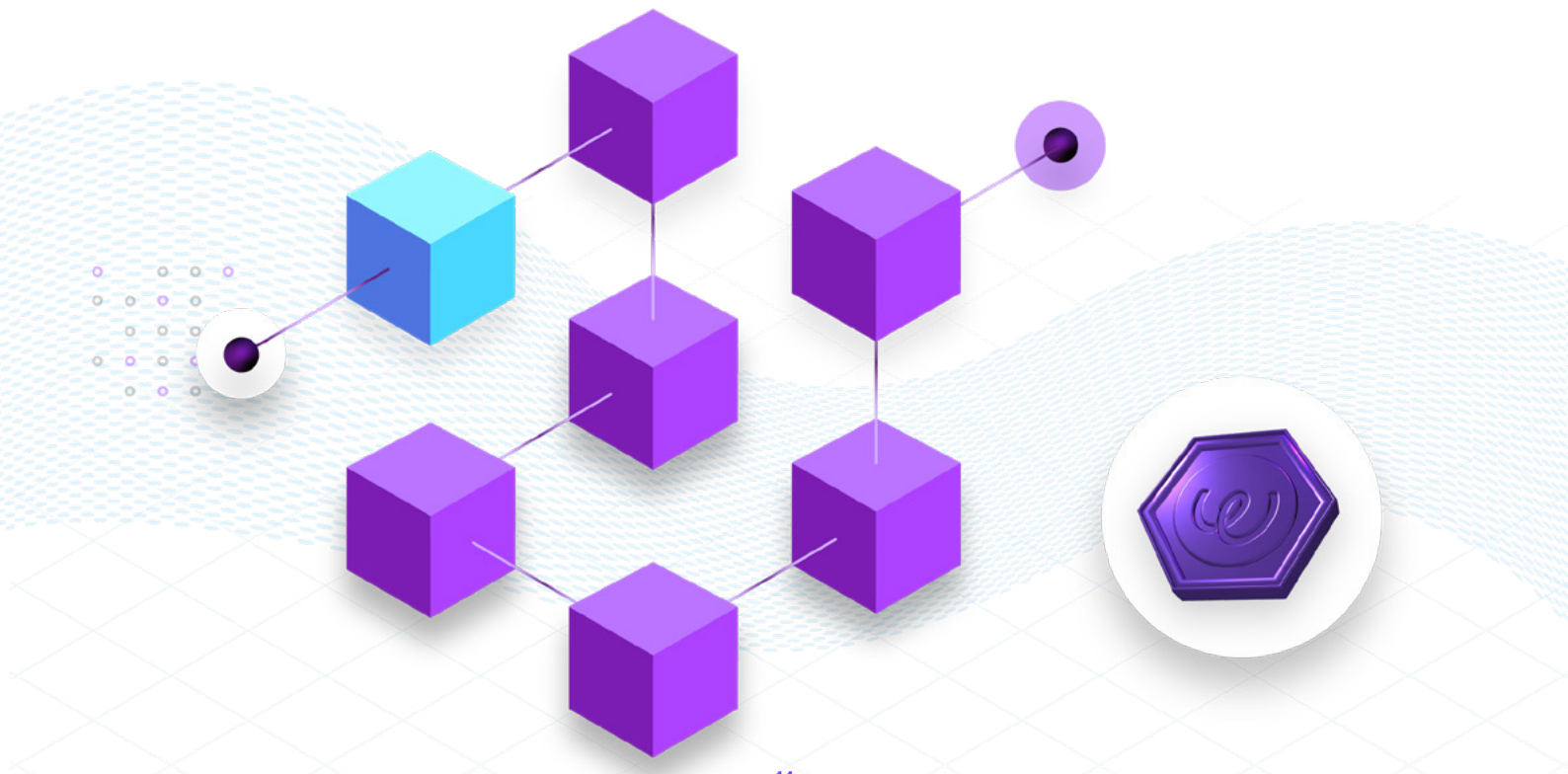
We believe there is a robust dSLA-supported market for Utility Layer services on the Energy Web tech stack.



The Utility Layer comprises a variety of 'digital machinery' (i.e., software services) that power the dApps running on the Energy Web Chain and facilitate decentralized application development. Utility Layer services are used in application development to integrate clean energy assets, customers, and marketplaces with the Energy Web Chain and with other actors and assets on the Energy Web Chain. They provide common, shared protocols for identity, communication, and information exchange through:

- **Identity and role-based access management to markets and applications** for organizations and applications that are anchored on the Energy Web Chain.
- **Decentralized messaging** between users and assets that operate at different levels of the grid, often with no existing communication protocols (for example, messaging between aggregators and transmission system operators).
- **Caching and name-spacing** for accessible user experience and optimal querying of the Energy Web Chain in applications.

The first service node on the platform will be an enterprise-grade RPC (E-RPC) node for the Energy Web Chain. Once the E-RPC is live, more blockchain-specific services will be added (graph nodes, databases, validator nodes, etc.).



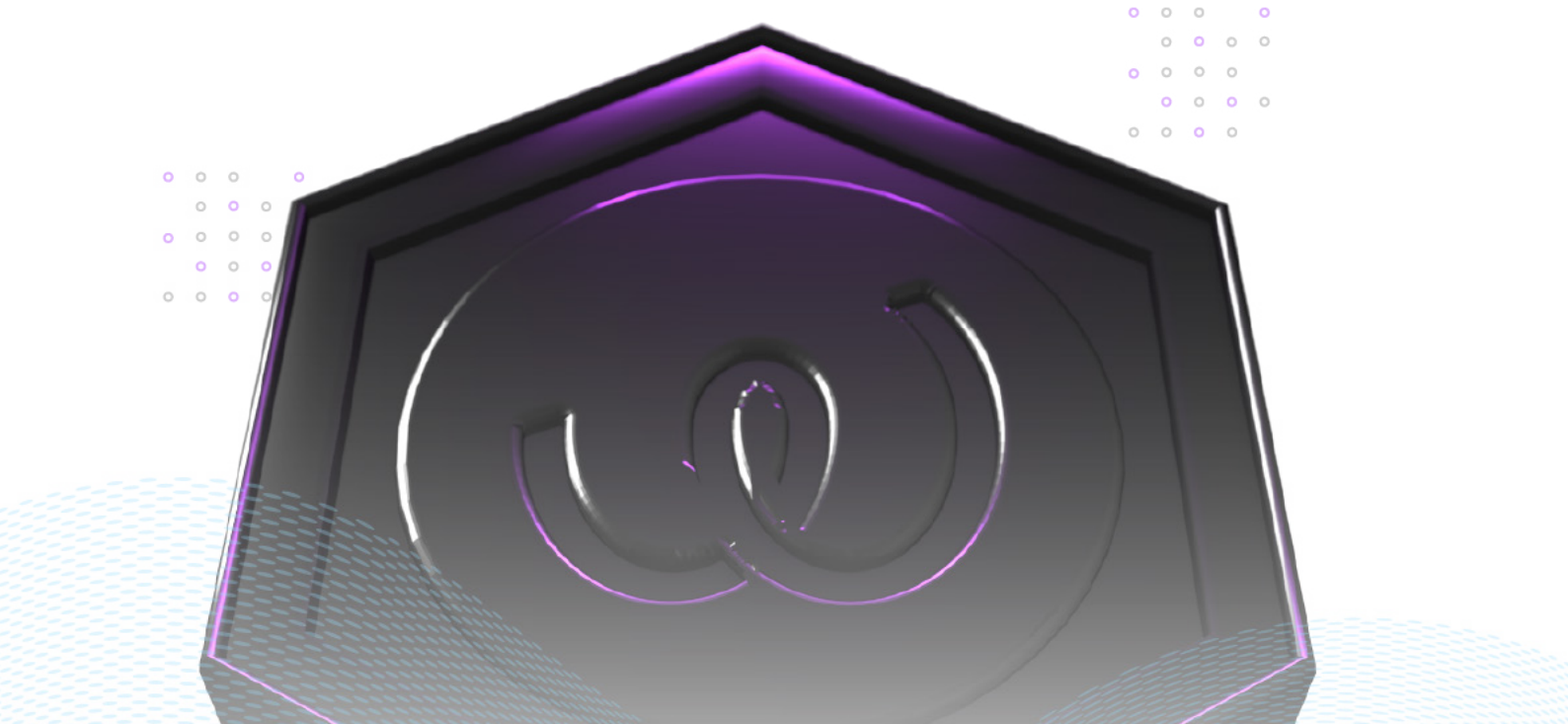
Energy Web Token ($EWT)

THE FUEL ON WHICH DSLA-SUPPORTED SERVICES AND UTILITY LAYER *DIGITAL MACHINERY* RUNS

Every 'digital machinery' needs to be properly calibrated, maintained, and operated. In our decentralized ecosystems, the key technology enabling all of this will be token economics. Independent service providers (Providers) will decide which specific service node to operate based on price signals on the platform. Patrons will decide how to stake their $EWT based on the risk/reward profile of the Providers' staking pools. Finally, clients will be able to pick their Utility Layer service with confidence, thanks to the performance guarantees provided by security deposit requirements and crowd-sourced curation mechanism provided by staking Patrons.

On the dSLA platform, every business activity happens around $EWT. Energy Web Tokens are required as security deposits from Providers and are needed for staking, allowing Patrons to participate in network rewards. $EWT will also be the collateral locked up to mint stable coins for payments on the platform.

$EWT will be the first and only (to our best knowledge) blockchain token with real-world utility, tied to real-world cash flows. It will encapsulate all the leading-edge token economics ideas and implementations in order to align the incentives of all the stakeholders and accelerate the massive, global decentralized decarbonization economy based on DIDs and DID-enabled services.



Appendix

dSLA applications outside the energy industry

IoT

We also recognize that connected, smart energy devices are a subset of a much larger IoT market. IoT outside of the energy sector is not our primary focus. However, our DID infrastructure is technology-agnostic, open-source, and can be easily adapted by any manufacturers and operators of IoT devices.

Given the fact that energy-related devices underpin every aspect of our professional and personal lives, it is quite possible that Energy Web DID technology will be adopted by many other industries and sectors thanks to its flexibility, security, and focus on privacy. A shared, open-source solution widely used by regulators, grid operators, energy companies, solar installers, EVs, and consumers would be much welcomed by industries like agriculture, logistics, smart appliances, and many more.

For context, the total number of connected IoT devices is expected to reach **27 billion by 2025, growing from the current 12 billion already connected devices.**

source: **iot-analytics.com**

Other Blockchain Applications

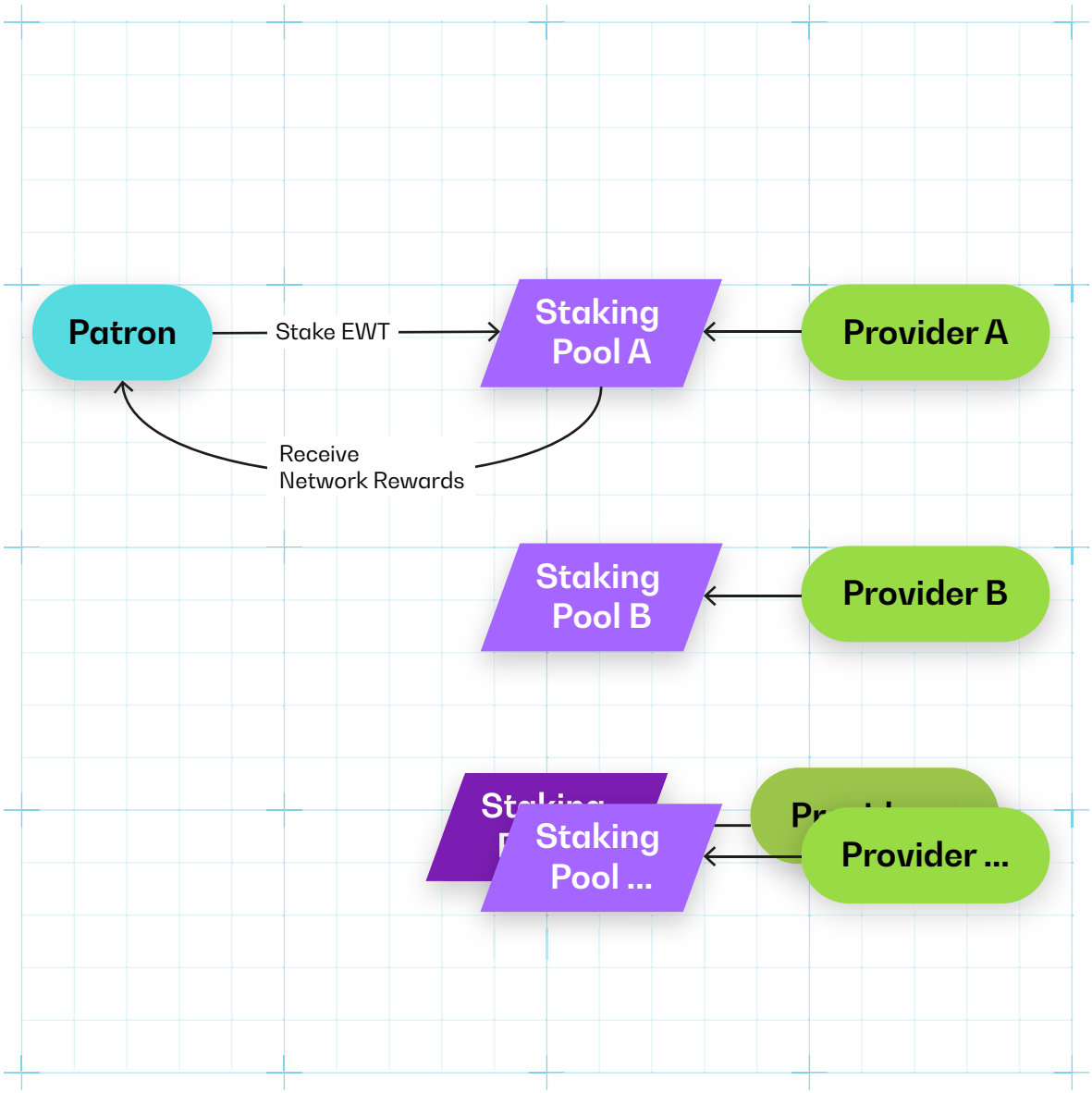
Based on our experience working with enterprise clients, we see a lack of enterprise-grade, easy-to-use utility services that support basic blockchain primitives. This is one of the reasons we have had to build them ourselves, like the E-RPC node and others.

Therefore, we see potential demand for our dSLA platform and utility nodes coming from the blockchain space itself, mainly from corporate and business users. It's difficult to quantify the potential demand, but we expect interest from users including crypto exchanges, crypto funds, companies who want to professionally operate validator nodes for any PoC blockchains, innovation labs, oracles, and dApp developers.

dSLA Stakeholders and Users

Patrons

$EWT (Energy Web Token) holders who decide to deposit their EWT into a Staking Pool to earn rewards. They can withdraw earned rewards at any time, but they will be paid after finishing the full 7-day reward cycle.

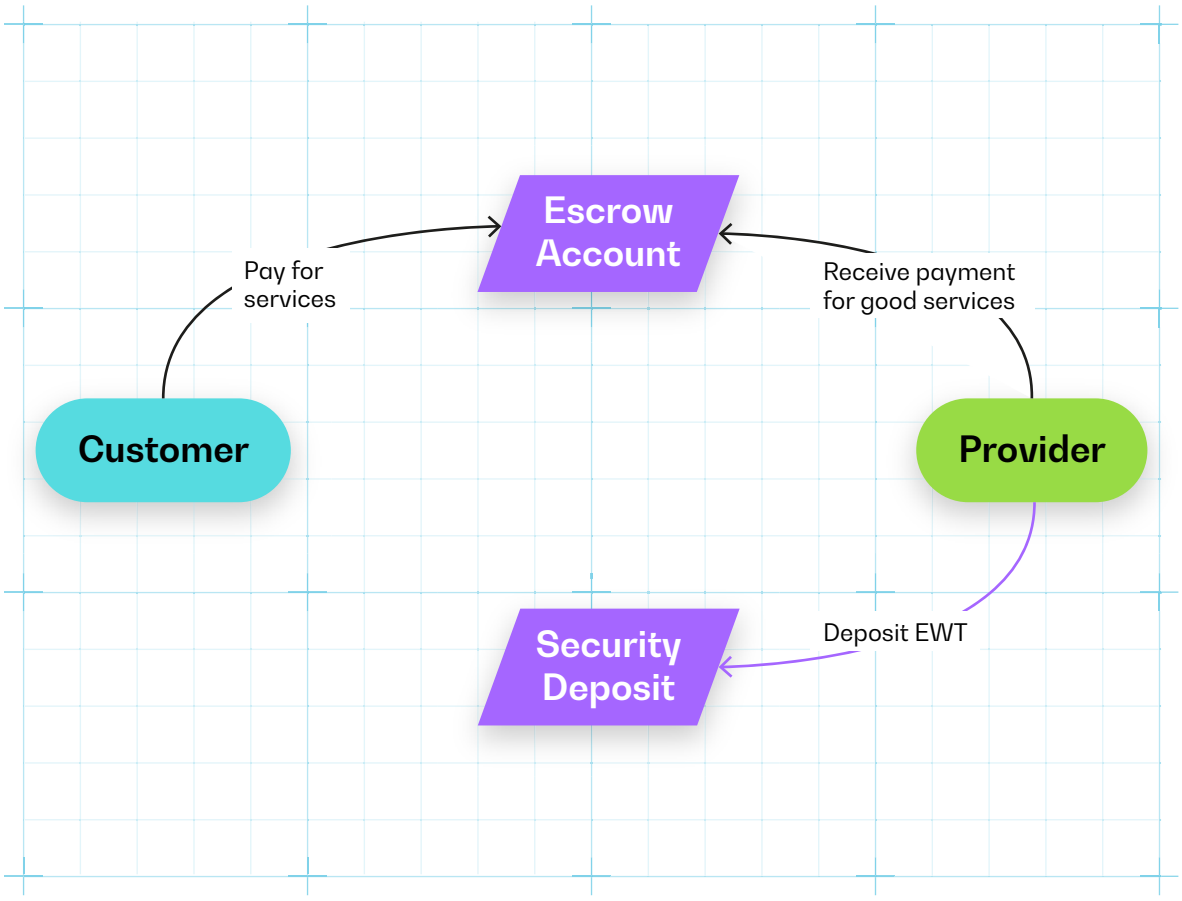


Customers

End-users of the Utility Layer software delivered through the dSLA platform, who use it internally (energy companies) or build products that utilize our stack (software/IT, product companies). They pay for a service using an escrow account that releases the payment after it has been delivered as promised. They will receive a refund or a discount if the service was not delivered as promised or of bad quality.

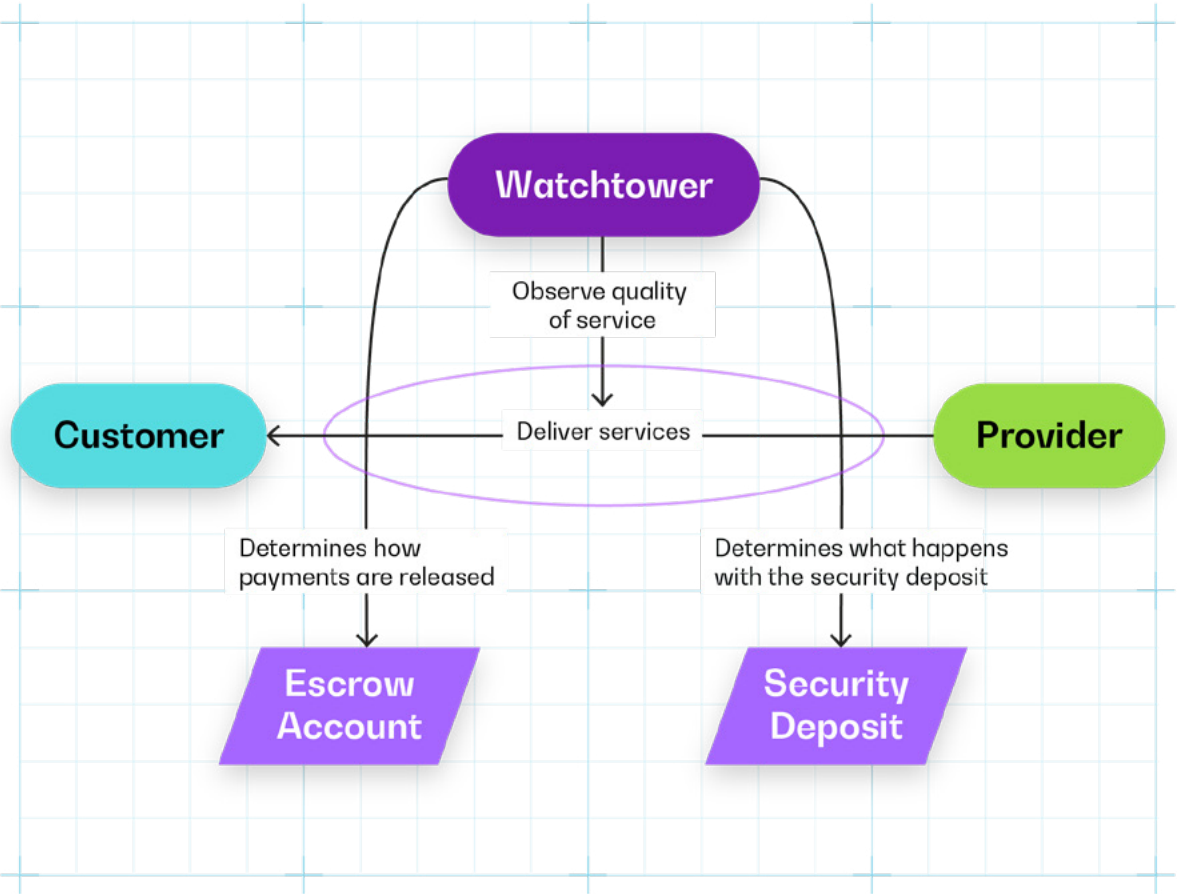
Providers

Organizations that launch and operate Service Nodes. To guarantee the level and quality of service, Providers have to pay a security deposit that can be slashed if the service delivery is bad. Providers receive payments for Clients through the escrow account.



Watchtower

It observes and measures the level and quality of services delivered by service nodes operated by Providers. Watchtowers issue service performance reports about every service provided in the Utility Layer. Providers' payment is dependent on the quality of services they provide, and the performance reports document and determine the quality of their services, so Watchtowers determine the payments received by Providers and/or refunds received by Clients.



dSLA components and terms used

U

Utility Layer

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- Caching and name-spacing for accessible user experience and optimal querying of the Energy Web Chain in applications

Utility Node (or Utility Layer Service Node or Service Node or Node)

The generic term for a node (server) running software to deliver a particular Utility Layer service.

Energy Web Token (EWT)

Energy Web Token (EWT) is a fixed supply, native utility token. Fixed supply, because there will never be more than 100,000,000 EWT in existence. Native, because it is the primary token on the Energy Web Chain (EWC), used to reward validators and anyone contributing to the ecosystem. EWC is an energy-efficient, enterprise-grade public blockchain that runs on 100% renewable energy.

S

Security Deposit

An amount of EWT that should be paid as a guarantee of good service quality. It should be paid before a Provider can launch the first node.

Slashing

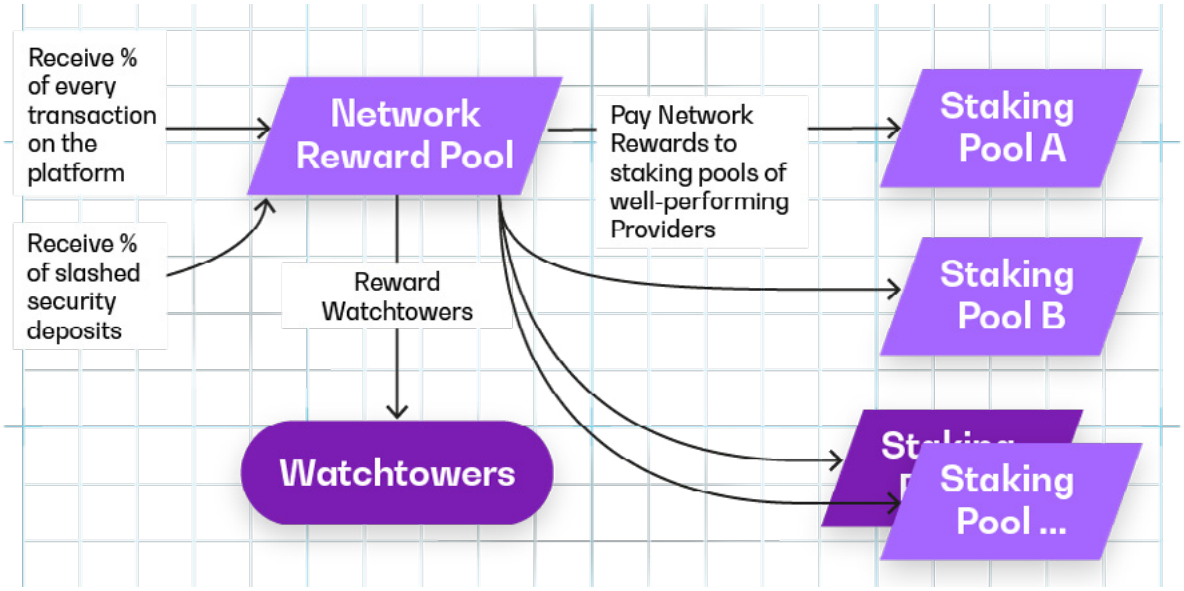
The process of taking an amount of EWT from the Provider's Security deposit for poor service performance (defined in service level agreement). Service performance is assessed by Watchtowers and documented in a weekly service performance report.

Network Reward Pool (NRP)

A pool, administered by a smart contract, that collects a portion of every payment on the platform. Additionally, NRP can be funded by slashing security deposits of badly performing Providers.

Network Pool rewards are distributed at the end of every Access Period and proportionately to the amount of the EWT staked in Staking Pools. The Providers with the highest amount of EWT in their Staking Pool will receive the largest share of the network reward.

In order to maximize their EWT stake, Providers can invite Patrons to stake EWT in their Staking Pools. Network rewards are only distributed to Staking Pools of the well--performing Providers. Providers who provided bad services during the recent Access Period will not receive any network reward. Watchtowers also receive network rewards from the NRP.



A

Access Period

A 7-day cycle of service delivery, verification, and rewards distributions. Each service node can be subscribed to for a minimum of 1 Access Period.

Staking

In the context of blockchain and tokens, it's the ability to lock or deposit tokens into an account or a smart contract to access specific functions, features, or utilities. This may include access to a service, the ability to perform a service, earn rewards, vote, etc. Staking on dSLA allows Providers and Patrons to deposit EWT into Staking Pools and earn network rewards.

Escrow Account

A smart contract that guarantees payment for services and the quality of the services delivered. It holds Managers' up-front payments for service nodes. If a node performs as agreed in the dSLA, the payment is sent to Providers. If not, Managers receive a refund.

Staking Pool

A type of smart contract that each Provider can launch in order to participate in Network Rewards distributions. Only one staking pool can be launched by a Provider. Providers can also allow Patrons to deposit EWT and earn rewards. Providers define the reward split between themselves and Patrons.

Staking Pool will never be slashed. However, if the Provider doesn't perform as defined in the dSLA, no network reward will be distributed to the Staking Pool during the Access Period.

Patrons can join as many staking pools as they wish.

Staking Process

In the context of dSLA, let's think of staking as a process of committing something of value in order to minimize transaction costs between parties. In plain English: I want to sell you something, but we've never done business before, so you don't know if you can trust me if what I'm selling is any good. I need to commit something valuable to create a situation that makes you feel secure. Traditionally companies committed (or staked) their brand reputation, license (for example accountants or lawyers), or a security bond (a common practice in the construction industry).

This creates a situation that the incentives of both parties are aligned: you and I both want the transaction to go smoothly and be beneficial for the buyer. Otherwise, you are upset that you don't get the product you want, and I lose my stake (my reputation, my license, or a sum of money).

The staking implementation in dSLA serves exactly the same purpose of reducing transaction risks and associated transaction costs but uses technologies like blockchain, smart contracts, tokens, and game theory to reduce transaction risks in a community-driven, decentralized fashion. There are 2 mechanisms in place that serve this purpose:

- Patron staking and earning Network Rewards
- Providers Security Deposits and slashing.

Patron Staking

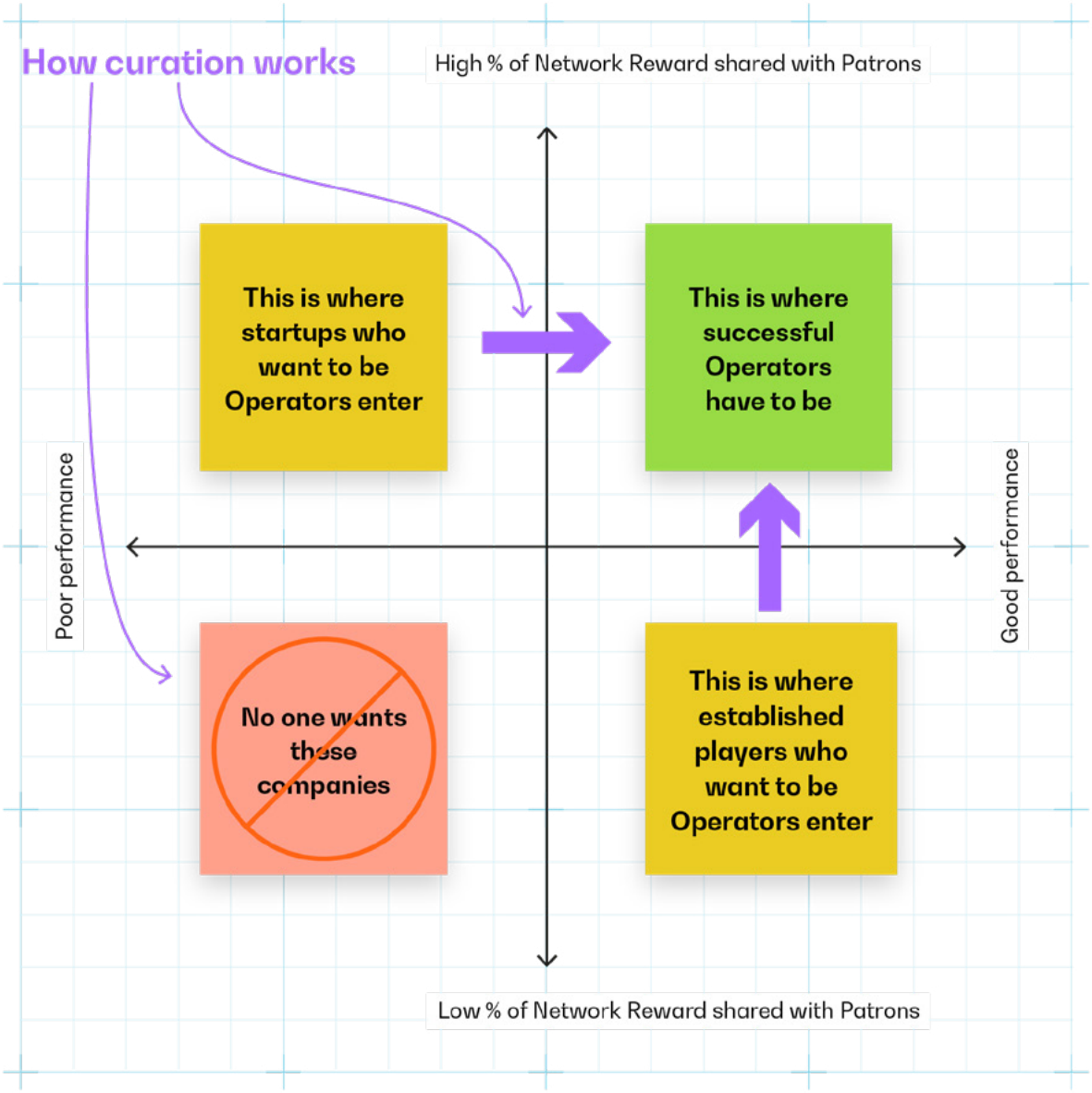
Patrons have the opportunity to earn Network Rewards in exchange for their contribution to curating the services and service providers. Through staking, Patrons will ensure the quality of service and providers on the platform and the amount of their staked EWT can be used as the best trustless, community-driven proxy for reputation.

Patrons can deposit their EWT into any of the available staking pools launched by providers. Each provider can launch only 1 staking pool. Every week, the dSLA platform distributes Network Rewards to all staking pools. The amount of the rewards is proportionate to the stake in each staking pool. For example: If Staking Pool 1 has 10% of the EWT deposited in all staking pools, it will receive 10% of the Network Reward. However, only providers who perform high-quality services will receive these rewards.

Service providers who underperform (services were not available or below the standard agreed in dSLAs) will not receive any rewards.

When launching staking pools, providers decide what % of the Network Reward they will share with Patrons. For example: If Staking Pool 1 shares 90% of the reward with Patrons, it means that every time it receives a Network Reward, 90% of the reward goes to Patrons and the provider keeps 10% of the reward.

In order to earn Network Rewards, Patrons will deposit their EWT with providers who perform well (earn rewards consistently) and share the highest % of their reward with Patrons. Since the amount of EWT in providers' staking pools is a reflection of their performance and community engagement, it will be a significant factor for clients who are selecting service providers. The competition between providers and the decisions made by staking Patron will shape the supply and ensure the quality of service on the platform.



Security Deposits

The security deposits on dSLA are another form of staking value in order to maintain the high quality of decentralized services. Providers are required to pay a security deposit for every type of service they want to provide. All security deposits are paid in EWT.

The entire time they run service nodes, their security deposit is locked in a smart contract. If the Provider provides bad services, their security deposit will be slashed, meaning it will be forfeited as the penalty for bad service.

There is a minimum amount of security deposit required from Providers to run every service, however, there's no maximum limit. This means the providers will be able to voluntarily deposit a higher amount to show their level of confidence and commitment to quality.

Clients who want to subscribe to services on dSLA are inclined to choose providers who have the highest amount of the security deposit and the highest amount of EWT staked in their staking pool.

Both the Patron Staking and the Security Deposits are forms of staking in the economic sense, as understood by game theory. However, we make a deliberate distinction between the two for one very important reason: Staking Pools will never get slashed. Patrons might be exposed to a risk of not earning network rewards, but their original stake will never be forfeited. Security deposits on the other hand can be slashed, so Providers will be exposed to a risk of potentially losing all their EWT if they perform poorly.

How dSLA works for Patrons

Patrons can browse Staking Pools on the dSLA platform to see

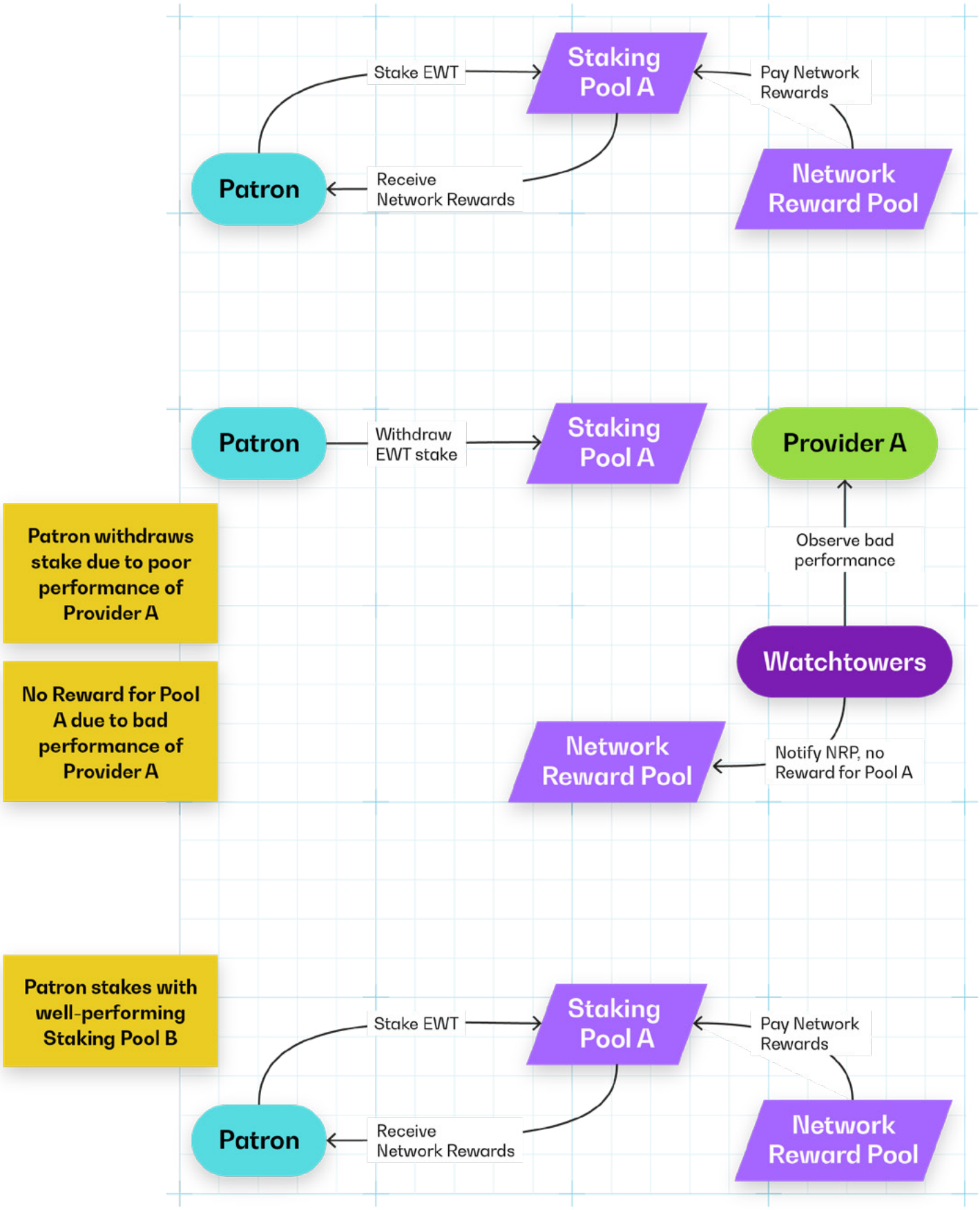
- which staking pools are open for patrons,
- the current EWT balances of the staking pools,
- performance of the providers
- Network Reward distribution history
- Network Reward split % between Providers and Patrons

Then, they can decide to deposit their EWT into the selected staking pool(s). EWTs in the pools can be withdrawn at any time (no lock-up period).

Patrons who stake receive weekly rewards. The rewards are distributed to every staking pool on the platform proportionally to the total amount of EWT deposited in each staking pool. For example, if Staking Pool A contains 10% of the total EWT deposited into dSLA staking pools, it will receive 10% of the weekly network reward.

Then, the reward from the staking pool is distributed to Patrons. Again, this is done based on the amount of EWT they staked. So, If Patron 1 deposited 50% of EWT staked in the Staking Pool, they will receive 50% of the network reward, minus the provider fee. The fee is determined by the provider when they launch the staking pool. The fee can vary between 0% and 100% (0% means Patrons don't pay any fees, 100% means that providers keep all the rewards and Patrons receive no reward at all).

Network Rewards are only paid to staking pools of well-performing providers, so if Provider A's service node was performing badly, their staking pool will not receive the network reward that week.


Stake EWT
Staking Pool A
Pay Network Rewards
Patron
Receive Network Rewards
Network Reward Pool
Patron
Withdraw EWT stake
Staking Pool A
Provider A
Patron withdraws stake due to poor performance of Provider A
Observe bad performance
Watchtowers
No Reward for Pool A due to bad performance of Provider A
Network Reward Pool
Notify NRP, no Reward for Pool A
Patron stakes with well-performing Staking Pool B
Stake EWT
Staking Pool A
Pay Network Rewards
Patron
Receive Network Rewards
Network Reward Pool

How dSLA works for Service Providers

Each company has to complete a KYC and a verification process to be approved as a Service Provider on dSLA. Once approved, a provider can browse the available white--listed, verified service nodes that can be launched and offered on the platform. Each service has its own pre-determined decentralized Service Level Agreement (dSLA) that determines the requirements and deliverables (quality and quantity of the service, required security deposit, location, availability, etc.) for each type of service node. Based on dSLAs, providers can decide which type of service node to run.

Next, a provider has to pay the required security deposit. The amount of the deposit is denominated in fiat (national currencies like $, EUR), but paid in EWT, based on the current EWT market price. For example: Assume the security deposit amount is $10,000. If the EWT price is at $10, the provider needs to pay 1,000 EWT into the security deposit. If the price is at $5, the same $10,000 deposit now requires 2,000 EWT to be paid.

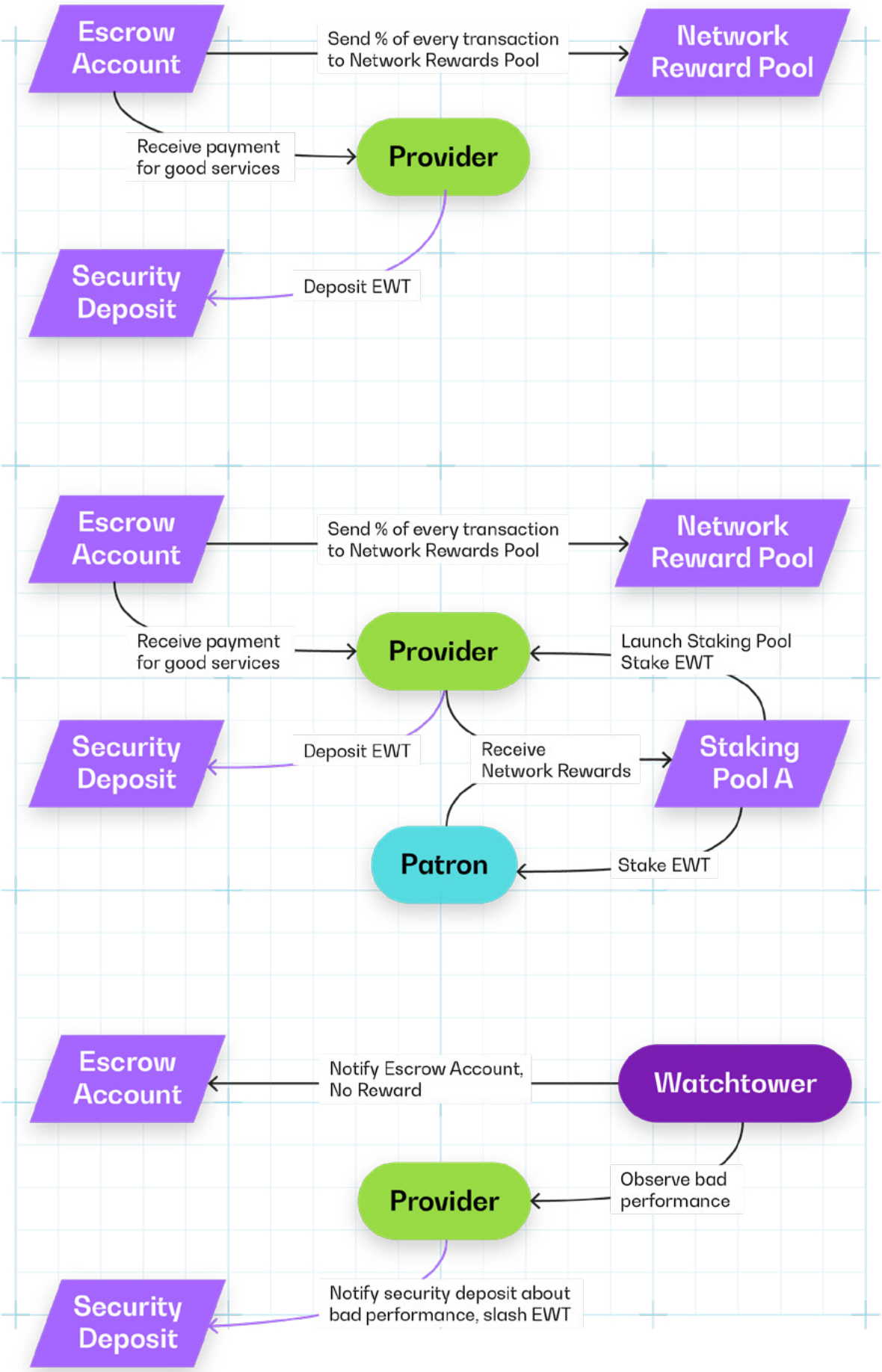
Once the security deposit is paid, the provider can now launch the selected service nodes and offer them on the dSLA platform. At this moment, the security deposit gets locked and can only be withdrawn if the provider stops running all the nodes.

Each service node is offered for the seven-day cycle access period and will earn revenue paid at the end of every access period, subject to the quality of services provided. Payments to Providers are released from the Escrow Account. Each subscriber wanting to use service nodes (a Client or a Manager) has to pay for services in advance, by depositing funds into the Escrow Account.

Each Provider can also launch one Staking Pool, in order to earn Network Rewards (as described above). A provider can only have one staking pool, even if they run more than one type of service node. This is to ensure that the quality of every service provided is high.

Every week, based on the service performance, Providers receive direct payments from the Escrow Account and Network Rewards, if they decide to launch a staking pool. In the event of bad service quality, Providers will not receive payments from the Escrow Account (funds will be returned to the subscriber) and their security deposit will be partially or entirely slashed.

The best-performing Providers, who can attract the most stakes from Patrons, will be able to secure the most demand from subscribers (clients and managers).


Escrow Account
Send % of every transaction to Network Rewards Pool
Network Reward Pool
Receive payment for good services
Provider
Security Deposit
Deposit EWT
Escrow Account
Send % of every transaction to Network Rewards Pool
Network Reward Pool
Receive payment for good services
Provider
Launch Staking Pool Stake EWT
Security Deposit
Deposit EWT
Receive Network Rewards
Staking Pool A
Patron
Stake EWT
Escrow Account
Notify Escrow Account, No Reward
Watchtower
Observe bad performance
Provider
Security Deposit
Notify security deposit about bad performance, slash EWT

Join our community!

If you care about climate change and support our mission, here are additional resources explaining how you can **get involved!**

About Energy Web

Energy Web (EW) is a global nonprofit organization accelerating a low-carbon, customer-centric electricity system by unleashing the potential of open-source, decentralized technologies. EW focuses on building core infrastructure and shared technology, speeding the adoption of commercial solutions, and fostering a community of practice.

Visit **energyweb.org** to find out more.