A Web3 Infrastructure For The Real World Economy

Whitepaper V1.3

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Abstract. Many organizations remain unwilling to share proprietary operational data through centralized platforms, limiting the scalability, transparency, and coordination of global chains. As a result, Web2 architectures have failed to provide the trustless, privacy-preserving infrastructure required for cross-organizational data exchange, automation, and innovation. Unova addresses these limitations by introducing a purpose-built Web3 infrastructure designed for real-world asset and production ecosystems.

Unova-Mainnet is an L1–L2 hybrid blockchain network that combines decentralized consensus with privacy-enabled, off-chain data distribution. Through a multi-node architecture—comprising validator nodes (Type-1), data and application nodes (Type-2), and open innovation nodes (Type-3)—Unova enables organizations to retain full ownership and control of their data while participating in shared, auditable and private workflows. Smart contracts function as a distributed state machine, coordinating complex business processes, enforcing rules, and enabling automated execution without reliance on centralized intermediaries.

A core component of the architecture is Unova's privacy-enabled data distribution protocol, which allows data to be selectively shared across configurable stakeholder clusters while anchoring integrity and provenance on-chain. This approach preserves data privacy and immutability, ensures auditability by design, and enables scalable coordination across diverse industries and jurisdictions. By decoupling data storage, application logic, and

blockchain consensus, Unova supports mass adoption without sacrificing decentralization or performance.

Beyond current supply chain challenges such as traceability, recalls, compliance, and inefficiency, Unova provides an open foundation for future innovation. The network enables third-party applications, decentralized financial services, and AI-driven automation to be built directly on trusted, verifiable data flows. Through its native token (UON) and crypto-economic incentives, Unova democratizes access to infrastructure and governance, positioning itself as a long-term, open Web3 backbone for global production, trade, and data-driven collaboration.

1. Introduction

The modern economy runs on data, yet the infrastructure used to generate, share, and act on that data remains fundamentally misaligned with how value is created across independent organizations. Most digital systems today are built on Web2 architectures that rely on centralized platforms, intermediaries, and trusted third parties. These systems require participants to surrender control over proprietary data, creating structural resistance to collaboration and limiting the scope of what can be coordinated at scale.

The absence of an integrity-driven, decentralized data infrastructure introduces systemic inefficiencies and risk. Fragmented data ownership and siloed systems lead to incomplete visibility, unreliable inputs, and costly reconciliation processes. Organizations face increased operational overhead, compliance burdens, audit complexity, and decision-making uncertainty. More importantly, the lack of shared, trustworthy data prevents automation, real-time coordination, and the emergence of new economic models that depend on cross-organizational interaction.

Legacy enterprise systems are optimized for internal efficiency, not for shared execution across multiple autonomous actors. As a result, they fail to capture the full set of events, states, and dependencies that exist beyond organizational boundaries. Without a trust-minimized infrastructure, it is impractical to implement systems that require multiple parties to coordinate logic, exchange value, or automate outcomes without relying on central operators. This limitation extends beyond any single industry and affects finance, production, logistics, energy, data markets, and emerging AI-driven systems alike.

Web3 introduces a fundamentally different paradigm. Blockchain-based distributed state machines, smart contracts, and native cryptographic tokens enable coordination without centralized gatekeepers. They allow logic to be executed transparently, deterministically, and autonomously across untrusted participants. When combined with scalable architectures and privacy-preserving data distribution, Web3 enables shared execution while preserving data sovereignty, accountability, and auditability.

Unova is designed as a multi-layer Web3 infrastructure that goes beyond data immutability or transaction settlement. At its core, Unova provides a decentralized execution layer for coordinating real-world systems, digital assets, and economic activity.

It enables verifiable data generation, selective and privacy-enabled data sharing, and on-chain orchestration of off-chain processes. This foundation supports a wide range of higher-level capabilities, including decentralized financial services (DeFi) built on trusted real-world data, AI-driven automation that can both analyze data and trigger on-chain execution, and non-fungible tokens (NFTs) that link digital ownership, financial logic, and real-world actions.

By decoupling data ownership, application logic, and infrastructure governance, Unova enables open innovation without lock-in. Developers, organizations, and institutions can build independent applications, deploy smart contracts, and create new business models on a shared, trust-minimized foundation. Rather than optimizing isolated processes, Unova enables programmable coordination across ecosystems.

The convergence of decentralized data infrastructure, smart contract execution, cryptographic incentives, and automated decision systems marks a shift toward programmable economies. Realizing this shift requires infrastructure that is open by design, scalable in practice, and usable by real-world actors. This white paper introduces Unova as a Web3 foundation built to meet these requirements and to support both present-day applications and future decentralized economic coordination across industries.

1.1. A trustless infrastructure[1] — When dealing with proprietary production data, which the companies usually only store on the internal servers, it is essential to create a trustless infrastructure. Data distribution should not require numerous stakeholders to send their data to a server hosted by an intermediary (neither a central authority nor any other company), as this makes the organizations reluctant to join such a system.

1.2. From web2 data silos to web3 infrastructure — Web2 refers to the version of the internet most of us know today. An internet dominated by the companies that provide services in exchange for data. Web3 refers to the movement towards a more decentralized internet where applications are using blockchain technology to give users more control over their actions and data instead of relying on big tech companies. Essentially the blockchain is used to allow for a distributed state machine, free from big tech intermediaries, where each state is validated by many nodes, which allow for smart contracts and become the basis for Web3. Decentralized data architecture is changing how the web works. It moves the internet into a new era, building the path

[1] An infrastructure where trust is built into the system design making trusted third parties redundant

toward common data standards and protocols. The decentralized infrastructure makes it possible to run applications that understand the internal and/or external, private and/or public data maintained by an organization or firm. It allows for:

- Each company to keep control over their data and who they wish to share it with
- A basis on which government agencies and companies can build for many years to come.

The most important evolution enabled by Web3 is the minimization of the trust required for coordination on a global scale. This marks a move towards trusting all constituents of a network implicitly, rather than needing to trust everyone explicitly and/or seeking to achieve trust extrinsically. This is essential for creating global cross-border data exchange, where companies may not trust one organization to manage their data.

1.3. Data distribution scalability — Essentially, building "the internet" of asset chain data requires large data distribution capabilities while at the same time maintaining its decentralized and immutable nature. It is only a hybrid solution of L1[2] combined with L2[3] and L3[4] that leads to a fully integrated solution that is scalable and, at the same time, works in the optimal way to convince all asset-controlling stakeholders to introduce the technology to their business. At a later stage, this results in a network that is designed and branded as the asset chain network on which companies can also start deploying their own custom-designed smart contracts and applications, paving the way for future innovation and impact.

1.4. Data privacy & distribution control — A single network to which any (global or domestic) asset-holding stakeholder can join requires privacy-enabled data distribution clusters and cross-cluster distribution capabilities. Essentially this means that each participant within the network needs to be able to control which stakeholder will receive specific bundles of data. This creates a hybrid between a public and private network, as, within the network, there will be clusters of corporate partners, but at the same time, each participant in such a cluster may still receive data from outside this specific cluster (making it cross-cluster). It accommodates asset stakeholders being part of multiple asset chains. The result is not a private network where each stakeholder launches a separate private network with its own applications, nor a basic public network where all nodes globally store a copy of all asset data eliminating any privacy aspect and putting a strain on scalability. Instead, a hybrid integrated solution is needed allowing for data distribution pools of business partners within a global network with many built in contracts and available applications. The public nature of the blockchain and the UVM (Unova Virtual Machine) provides what one could refer to as a "world computer" with protocols built into smart contracts

[2] Layer 1 refers to the actual blockchain architecture [1]
[3] Layer 2 refers to the various protocols built on top of Layer 1 [1]
[4] Layer 3 refers to blockchain-based applications such as DApps (decentralized applications)[1]

responsible for allowing vast amounts of data distribution. We refer to the network as being an L1-L2 hybrid infrastructure, for lack of a better term.

1.5. Auditable by design — One of the first reasons why people link blockchain to asset management is immutability. Immutability is a useful specification to ensure all participants know that the data they receive has not and cannot be altered. It makes the solution auditable by design. In other words, creating transparent and immutable records has obvious utility for logistics, supply chains, legal record keeping, real world assets, and AI data integrity. Creating digital entities and their associated events and distributing them across stakeholders in an immutable manner creates a responsibility for each organization to be correct. Immutability alone is not sufficient for ensuring that all data is reliable. However, a combination of the following aspects does make it increasingly difficult/risky to engage in fraudulent behavior:

[1] Covering all data points (and creating transparency)

[2] Blocking of fraudulent registrations based on related data

[3] Monitoring the data (automated scripts)

[4] Increasing the detection risk

[5] Maintaining the truth when it is at stake (immutability or auditability)

Combining different aspects lead to a game theory situation where sufficient incentives are created leading to the desired outcome. The focus should not be on solely creating an anti-counterfeit solution, as many problems faced by asset-producing stakeholders (and governments) are not caused by counterfeiting but simply a lack of data availability or distribution infrastructure. However, maintaining immutability remains valuable as part of the architecture, increasing the reliability of the overall solution as such.

1.6. Distributed state machine — Blockchains are not solely valuable as an immutable place to store transactions and data: the introduction of smart contracts, which uses the blockchain as a distributed state machine, unlocks the value to whatever imaginable or can be executed. It's about building a "world computer" where software systems understand the data and decide what needs to happen to the data without the need for a (web2) middleman to host the system. When considering web2-based supply chains, there is a lack of compatibility because of multiple software systems, with each having different data fields. The protocols that can be built into a public blockchain network provide the solution accommodating complex business processes by leveraging smart contracts allowing for different systems to communicate with each other.

1.7. An open infrastructure at its core — Essentially, this means creating a plug-and-play solution where open innovation potential is maintained. Companies need to know that the system they are working with will last them for many years to come. A Web2 solution allows only the creator or owner of the system to do updates but does not allow the users to be part of the governance to impact the direction of the network, nor does it allow anyone to deploy additional smart contracts, build more applications or build new business models on top of the solution. Therefore, an L1 with its native crypto coin and public nature (open Web3 solution) is required to have a lasting impact. Companies host the databases, APIs, and applications, eliminating friction and promoting future innovation going beyond the imagination of any single team or organization.

1.8. Available applications — Companies have understood the value that digitization has brought to their business; it is now time to show what digital ecosystems and data distribution will bring. Fragmented data centers with existing silos are the basis of many problems for companies (and government bodies) today. It's not sufficient to provide a network or infrastructure on which companies can build. The first step is to show what can be done by providing applications that solve the problems that companies are aware of today. Allowing companies to add additional capabilities and making this possibility part of the current basis guarantees the stakeholders that the investment made when implementing the technology allows for future innovation and differentiation. It is about proving value today and facilitating the development of value in the future.

1.9. Data structure — Creating a network that allows for massive global impact requires the applications but also the data structure that allows flexibility to what and how data is collected, structured, distributed, and displayed to the many stakeholders. In addition, it should be relatively simple to introduce to business processes allowing the networking effects required to scale the system to take place.

1.10. Easy onboarding — An essential ingredient for scaling a new technology to achieve global impact is not only the value of the technology but also the ease of introducing the technology to accommodate network effects where value increases with each new user. Therefore, intuitively guiding the user through the process will especially be of critical value for early adopters.

2. The Unova solution

Unova is a complete Web3 solution where users maintain control. Unova-Mainnet is an L1-L2 hybrid blockchain network configured and designed to accommodate complex business processes by leveraging smart contracts and Type-2 nodes managing off-chain data, applications, and APIs. It includes a protocol that leverages privacy-enabled data distribution, cross-cluster distribution, and a multi-layered architecture. Unova has developed its native blockchain network based on extensive feedback from companies dealing with global assets and leveraged these learnings to create a system architecture that accommodates complex business processes. An important distinction is that blockchain is not solely used for immutability but instead as an enabler for the various smart contracts running both the current and future applications. Contrary to incumbent solutions, the applications, databases, and APIs are hosted by the users of the network who keep full control, resulting in this pure Web3 solution. In what follows, Unova's main characteristics are described.

2.1. L1 & L2 hybrid blockchain network — When installing a node and becoming part of the network, the user chooses the functionality contained by the node. Each type has specific configurations and protocols to serve its function.

Type-1: This type of node is mainly used for increased decentralization, network security, creating blocks, hashing power, and managing the execution of smart contracts and other transactions.

Type-2: This type of node is designed to be used by anyone wishing to leverage the applications and data distribution connections to be able to distribute to another Type-2 node. These are designed to accommodate and provide the data handling capabilities, Unova privacy-enabled distribution protocol, and Web3 solution where the users are at the driving seat. These node types will have different connections with each other. All new nodes connect to a few existing nodes based on a specific time period and location, allowing them to be part of the network by using the discovery protocol: *boot node*. This connection is responsible for distributing the blockchain data and allows for the consensus to exist. The second type of connection, made by type-2 nodes, allows for data distribution clusters and cross-cluster distribution of the actual large amount of data that would not be possible to store directly in a block (because of privacy considerations and limited block sizes). These node configurations and functions are a part of the same network and allow for high scalability and a user-friendly experience which is an important consideration for mass adoption.

Organizations can choose to operate both a type-1 node and a type-2 node. Operators of Type-1 nodes are rewarded for creating blocks, validating data, sheltering data, and managing the multiple states. This allows for smart contract execution. In most cases, hosting a type-2 node is sufficient as this allows the organization to make use of Unova's platforms and distribute the asset related data to business partners.

Type-3: This type of node can be referred to as an Open Innovation Node (OIN) as it is the most basic form of a node part of the Unova network. Type-3 nodes combined with SDKs enable open innovation and allow for new business models to leverage the infrastructure and data flows. They are designed to allow organizations to have basic functionality and flexibility to build and deploy additional smart contracts or connect to the network. Additional capabilities can then be added to accommodate the functionality that is intended. In what follows, Table 1 briefly summarizes the main features of each node type.

Table 1: Main features of each node type

[1] Node Type-1	● Create new blocks with transactions and write the same to the Unova blockchain. ● Manage the smart contracts and protocols. ● Process transactions. ● Validate and store the state of the blockchain. ● Operated by anyone wishing to participate in the network. ● Allow for a high level of decentralization. ● Maintain the Unova Virtual Machine. ● Installed through single command line Node Onboarding Package.
[2] Node Type-2	● Contain many Unova applications. ● Allow companies to share data with any relevant stakeholder. ● Operated by organizations that leverage the Web3 infrastructure and its applications. ● Validate and store the state of the blockchain. ● Contain data distribution protocols. ● Installed through single command line Node Onboarding Package.

[3] Node Type-3	● Are operated by organizations that leverage the Web3 infrastructure and prefer to have a basic node to add functionality to. ● Validate and store the state of the blockchain. ● Installed through single command line Node Onboarding Package.

2.2. Single command-line installation — To enable easy onboarding, the node types can be installed using the Node Onboarding Package (NOP). The NOP has a configurable UI that initiates services that allows deploying and setting up the node to a cloud or on-premise server with the necessary configuration that establishes a connection to the blockchain network and is also responsible for managing data processing. Instead of making companies go through a long process of installing all the different applications, Unova's NOP is designed to install more than ten applications in a single command line. This, together with a user-friendly onboarding platform, allows the easy onboarding and introduction of the technology to any company without prior blockchain knowledge. It is important to note that as Unova follows the web3 principle, no central authority should control anything; hence, each member of the network also hosts their own applications and APIs, as a consequence, creating a fully trustless and decentralized infrastructure.

2.3. Consensus mechanism — Unova initially uses a Proof-of-Authority protocol to determine which node gets to mint the next block. Any trusted authority or user can host these nodes, including government authorities and organizations if they wish to host one in addition to their Type-2 node. In the next update, Unova will transition to a Proof-of-Stake protocol after rigorous testing and after sufficient distribution of its native token UON. Once this is implemented, the node that gets to add the following block to the blockchain is determined based on the stake in the wallet linked to the Type-1 (validator) node by creating staking pools. This means the system will never require much computing power or electricity compared to a Proof-of-Work mechanism [2]. This ensures the sustainability of the system while still maintaining the highest level of security and immutability.

2.4. Mass adoption considerations — The combination of the multiple node types, Web3 architecture, and privacy-enabled distribution allows Unova to accommodate mass adoption of the technology for asset management use cases. Table 2 gives an overview of the aspects built into the system design specifically for mass adoption.

Table 2: Mass adoption considerations

[1] Transactions and data distribution capabilities:	The L1-L2 hybrid configuration, in combination with the Unova privacy-enabled data distribution protocol, leads to high data handling capabilities and thus a scalable system designed to accommodate the global production industry.
[2] Data privacy control	Unova allows for a combination of on- and off-chain data distribution leading to privacy while at the same time maintaining immutability, decentralization, and auditability of the data which is essential for the use case.
[3] low transaction fees	Blockchain networks have a limit on the number of transactions that can be executed, leading to network congestion and high gas prices. The consensus mechanism of Unova-Mainnet and the fact that Unova-Mainnet is focused on real world assets means that transactions do not need to compete (gas prices) with other transactions that may be executed on other networks. Therefore, the price can match the value of asset data distributed while executing the smart contract and remain low.
[4] Blockchain is not solely used as an immutable database	Most companies are still limiting their understanding of blockchain to an immutable database, but it can be a basis for much more. Enterprise solutions push innovation towards a web2 solution with a blockchain attached to it. As opposed to limiting the use of blockchain to an immutable place to store data with applications still hosted by a central authority, Unova leverages smart contracts to form a web3 solution where the user remains at the driving seat. Therefore, creating an integrated web3 solution.
[5] Blockchain is not solely used as a distributed ledger	Early projects fail to utilize the real value of a blockchain, i.e., a distributed state machine. Instead of solely using the immutability and integrity provided by blockchain, Unova also utilizes its real value and enables diverse application logic to be deployed on its blockchain in the form of smart contracts.

2.5. Building a community of innovators — The technologies described throughout this whitepaper are designed to allow for open innovation, 3rd party business models, and the incentives corresponding to the crypto-economic model. Unova provides applications that serve a specific purpose today but also form a basis for the user community (and organisations) to build future capabilities. Unova believes it can bring together innovative minds from all over the world to build a future-proof, sustainable, transparent, safe, efficient, and secure production industry. Facilitation of collaboration between the community of people and organizations is a core Unova value.

3. Unova privacy-enabled distribution protocol

Independent organizations and systems form complex networks of interaction in which assets, data, and value move across multiple administrative and technical boundaries. Each participant typically operates its own internal software stack, optimized for local requirements and governed by independent policies. This results in fragmented data landscapes and the creation of isolated silos, even when the underlying activities are logically connected. As assets, digital resources, or state transitions move between actors, relevant information must be selectively shared with counterparties, regulators, service providers, automated systems, or end users. In practice, however, the absence of a shared and trust-minimized infrastructure makes this exchange inefficient, error-prone, and costly.

Although organizations often generate large volumes of high-quality data internally, siloed architectures prevent this data from being reliably exchanged or reused across systems. This leads to manual reconciliation, delayed decision-making, limited transparency, and reduced automation. In critical situations—such as financial settlements, risk management, compliance enforcement, system failures, or safety-related events—decision-makers and automated processes require access to timely, verifiable, and trustworthy data across organizational boundaries. Without a common execution and data coordination layer, responses remain slow, fragmented, or dependent on centralized intermediaries.

Unova introduces a novel approach to decentralized data distribution, coordination, and execution. The approach is grounded in Web3 principles and leverages a trustless infrastructure based on blockchain technology and smart contracts. Rather than relying on centralized platforms or third-party intermediaries, Unova enables participants to retain control over their data while coordinating logic and outcomes through a shared distributed state machine. This allows advanced applications to be built on decentralized web software protocols, enabling automation, transparency, and interoperability without sacrificing privacy or sovereignty.

At the core of this architecture is Unova's privacy-enabled data distribution protocol, designed to function as a foundational layer for decentralized applications across domains. The protocol enables selective and configurable data sharing, cryptographic integrity guarantees, and verifiable provenance, while supporting both on-chain coordination and off-chain data flows. By combining smart contracts with an L1–L2 hybrid architecture, Unova provides scalable infrastructure capable of supporting diverse asset models, automated execution, and next-generation applications spanning decentralized finance, AI-driven systems, NFTs, and real-world coordination. The key aspects of this distribution protocol are outlined in the following sections.

3.1. *Bundle configuration* — The configuration parameters to be set[5] for a bundle creation are the minimum bundle size and the checking period. The configured checking period determines how often the protocol checks if the minimum bundle size has been reached. If at the end of a checking period the minimum bundle size has been reached, a bundle will be created.

3.2. *Bundle creation* — The Type-2 nodes are responsible for creating, distributing and sheltering organizational assets and events data which is done by distributing bundles. These nodes are operated and hosted by the users of the system to provide a full web3 solution. Bundles are created by hashing the bundle data[6] to create a unique bundleId using the Keccak-256 hashing function. Keccak is a family of hash functions that is based on the sponge construction, and hence is a sponge function family [4].

3.3. *Distribution smart contract* — The distribution smart contract is executed to put the bundleId (Hash) inside a block as part of a transaction. In addition, the public keys of all partners who should be receiving the bundleData are placed inside this transaction. Part of the data distribution protocol is built into smart contracts to provide a secure, reliable, and transparent process.

3.4. *Data request* — Once the transaction is executed, the blocks are distributed to the other nodes in the network. Type-2 nodes monitor these blocks to find a transaction that contains their public key. This is done to avoid needless calls by the requester to the creator of the bundle as each node knows when it should be requesting the bundleData. If their public key is found, the Type-2 nodes download and store the bundleId. Once the bundleId is stored the bundleData will be requested from the creator of the bundle.

3.5. *Partner confirmation* — When a Type-2 node requests the data from the creator Type-2 node, the creator will validate whether it should be sending the data to this node by confirming with the partner list and the initial transaction.

3.6. *Data distribution* — If the requester node is a partner and the public key is part of the transaction, only then the bundleData will be distributed to the requesting Type-2 node.

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[5] 7.1 Tokenomics elaborates on the configurations decisions to be made

[6] Section 4 Data structure elaborates on bundleData.

3.7. Data validation — Once the bundleData has been received a final validation happens to confirm that the data has not changed. The bundleData gets hashed again by the receiving node and validated with the initial bundleId which was downloaded from the block. If it matches the data will be received and stored, if not it gets rejected.

4. Data structure

Unova's data structure allows any company from any industry to onboard easily. It allows companies to operate and make decisions independently, without disrupting their current business processes, while at the same time taking advantage of a bigger system that combines all the IT capabilities. Moreover, companies can continuously improve their processes and the data they collect and share with their partners. It facilitates access, view, and administration of complex business requirements without having to reconfigure the system. The flexible data structure and protocols followed by the nodes of organizations have been defined through the various demonstration projects (POCs) Unova has carried out, where operational flows have been carefully analyzed. In what follows the most important aspects are highlighted[7]:

4.1. Assets — An asset is a digital entity representing any physical, digital, or conceptual object, state, or resource within the Unova network. Assets serve as the foundational abstraction for modeling real-world and digital systems in a verifiable and interoperable manner. Depending on the use case, an asset may represent a physical object, a digital resource, a financial position, a unit of value, a dataset, a service instance, or a logical construct. Examples include, but are not limited to, physical goods, batches or collections, digital files, credentials, financial instruments, computational resources, AI models, datasets, NFTs, or any uniquely identifiable unit that participates in on-chain or off-chain processes.

4.2. Events — Events record any relevant, time-stamped occurrence, action, or state transition associated with one or more assets within the Unova network. Events represent changes, observations, interactions, or computed outcomes and serve as the primary mechanism for capturing how assets evolve over time. Depending on the use case, events may represent physical actions, digital interactions, financial transactions, system states, AI-generated outputs, or contractual executions. Events can carry arbitrary structured data and metadata, enabling the attachment of contextual information such as measurements, conditions, parameters, inputs, outputs, or references to external systems. This flexible event model allows Unova to support verifiable histories, automated logic execution, and cross-domain coordination without constraining how data is generated or interpreted.

[7]A more extensive explanation can be found in Unova's API documentation.

4.3. *Bundles* — A bundle is made by grouping assets & events[8] and accompanying data. Bundles have a unique ID that is crypto secured, which is called the bundleId, created by hashing all bundle data which ensures that a change in any data point will result in a different bundleId. Distributing bundles is initiated by placing the bundleId inside a transaction using the Unova distribution smart contract outlined in section 3.

5. Built-in Smart Contracts

5.1. type2Whitelist.sol

Description : Contract type2Whitelist is used to manage the whitelisting of a type2 node.

Address : 0xA1b8fD925e55cEece5dCB5756e11fb398E7eB74D

Type of Contract : Function

`function add(address candidate, Consts.NodeType role)` whitelists a type2 node.

`function remove(address candidate)` removes a type2 node from whitelist.

`function isWhitelisted(address candidate)` checks if node is already whitelisted.

`function hasRoleAssigned(address candidate,Consts.NodeType role(` checks if the type2 node has a role assigned to it, without which whitelisting cannot happen.

`function getRoleAssigned(address candidate)` fetches the role assigned to the node.

5.2. type2WhitelistStore.sol

Description : Contract type2WhitelistStore is used to store the address of a type2 node and its role. This contract is called by contract kycWhitelist to store information of the type2 node during whitelisting.

Address : 0x3FE5d52698fBA04B7c4cD26325FF9b97FcDAB30d

Type of Contract : Storage

`function set(address candidate, Consts.NodeType role)` stores the address and role of a type2 node.

5.3. roles.sol

[8]Note that bundles can be created from any data to be distributed between nodes aside from the standard asset & events format, allowing for other industry applications where the distribution protocol could be of value.

Description : Contract roles is used to manage the role and the url of a type2 node, while onboarding or retiring a type2 node.

Address : 0xAb085f2Cd278D9527f8890c5FB19eA08CC4FcA38

Type of Contract : Function

`function onboardAsType2(string nodeUrl)` sets the role of a node as a type2 node.
`function retireType2()` retires a type2 node and removes its role as a type2 node.
`getUrl(address node)` fetches the URL of a type2 node.
`function setUrl(string nodeUrl)` sets or updates the URL of a type2 node.

5.4. rolesStore.sol

Description : Contract rolesStore is used to store the role and url of a type2 node in the network. This contract is called by the roles.sol contract during onboarding or retiring a type2 node.

Address : 0x73BcDFeB6E4082e38e721d8713DC4263d64Bb968

Type of Contract : Storage

`function setUrl(address node, string url)` sets or updates the URL of a tyep2 node.
`function getRole(address node)` fetches the role of a type2 node.
`function getUrl(address node)` fetches the URL of a type2 node.

5.5. fees.sol

Description : Contract fees is used to process the application fees. Application fee is an additional amount, added to the transaction fee, which is a reward for developers within the Unova ecosystem.

Address : 0xd714b47A0271e5dC0CBb22287045418F774Af1F9

Type of Contract : Function

`function setCollector(address _Collector)` sets the address to which the application fee will be transferred.
`function getCollector()` fetches the address of the application fee collector.
`function setApplicationFee(uint fee)` sets the application fee.
`function getApplicationFee()` fetches the application fee.

5.6. bundleInfoStore.sol

Description : Contract bundleInfoStore is used to store and relay all the information about a bundle.

Address : 0xe688A89a55a098805Ca059Fe61e81aF51B6b91d7

Type of Contract : Storage

`function store(bytes32 bundleId, address uploader, uint64 currentTimestamp)` stores the bundle information.

`function bundleExists(bytes32 bundleId)` validates the uniqueness of the bundle.

`function getUploader(bytes32 bundleId)` fetches the information about the uploader of a bundle.

`function getUploadTimestamp(bytes32 bundleId)` fetches the timestamp when the bundle was uploaded.

`function getUploadBlockNumber(bytes32 bundleId)` fetches the blocknumber of the transaction containing the bundle.

`function getPartners(bytes32 bundleId)` fetches the addresses of the partners to whom the bundle data should be distributed.

`function addPartner(bytes32 bundleId, address partner, uint64 payoutPeriodsReduction, uint64 currentTimestamp)` adds a partner to the bundle information signalling the bundle has been stored by that partner.

`function removePartner(bytes32 bundleId, address partner)` removes a partner from the bundle information in case a type2 node retires.

5.7. bundleTransact.sol

Description : Contract bundleTransact calls functions from contracts bundleInfoStore, type2Whitelist, roleStore and fees. This contract can be used to retrieve and check all the information about the partners, bundles and the role of the type2 node. It is also used to execute the flow of uploading the bundle and storing it.

Address : 0xe688A89a55a098805Ca059Fe61e81aF51B6b91d7

Type of Contract : Storage

`addPartnerInternal(bytes32 bundleId, address partner, uint64 payoutPeriodReduction)` increments the bundle count of a type2 node. `function registerBundle(bytes32 bundleId, address[] partnerAddress)` calls four contracts (bundleInfoStore.sol, type2Whitelist.sol, roleStore.sol and fees.sol) and executes the bundle transaction flow. It includes the validations for the working of Unova privacy-enabled distribution protocol. This protocol allows cross-cluster data distribution to parties(nodes) chosen by the user.

5.8. **validatorSet.sol**

Description : Contract validatorSet is used to manage the whitelisting of a (Type-1) validator node.

Address : 0x0000000000000000000000000000000000000F00

Type of Contract : Storage and Function

`function addValidator(address _validator)` initiates addtion of a new validator to the existing validator set.

`function removeValidator(address _validator)` initiates removal of a validator from the existing validator set.

`function emitChangeEvent()` initiates a change to the existing validator set, to be later finalized by 'finalizeChange' function.

`function finalizeChange()` finalizes any change made to the set of validators (add/remove). Must be called everytime a change to the validator list needs to be activated.

`function checkInArray(address _subject, address[] _array)` checks if the validator address being processed (add/remove) exists in the existing validator set, and returns True or False.

`function getValidators()` returns the set of whitelisted validators.

`function getPendingValidators()` returns the set of validators which is not yet finalized by the `finalizeChange` function

6. Web3 democratization of the infrastructure and its currency

Instead of a token running on an existing blockchain (e.g., ERC-20 tokens based on the Ethereum network [5]), UON is a native token of the Unova network. This means that the utility of UON will go beyond the boundaries of the applications and the smart contracts built and deployed by Unova. Unova acts as the development company behind the network and provides vital operational support for its growth and business development. Unova will nurture cutting-edge applications built on decentralized web software protocols, and grow a community of supply chain innovators; Unova will fuel the growth and adoption of the technology. In the future, a smart contract deployed by any developer or company on Unova Mainnet will require UON to be used. International payments between companies or the automatic execution of payments upon delivery are also possible by executing financial transactions. Moreover, the network allows for the creation of NFTs which are transacted in UON. To have a fully decentralized public network, one of the important factors is the crypto-economic model designed to incentivize node operators to host a node, provide hashing power, and manage the blockchain along with its smart contracts. An essential part of any web3 solution is the democratization of the infrastructure and its currency. Through its decentralized nature, the community, external developers, or innovative companies will become stakeholders and contributors to the network. New business models can be created, supply chain financing (e.g., trade finance), and payment solutions provided in addition to any service or solution that may benefit global trade and supply chain operations. The end goal: Unova to become the world's supply chain network.

6.1. Tokenomics — The value of the UON token will be driven by demand and supply dynamics, due to its utility within the Unova ecosystem. Initially, the demand side will be fueled by companies that use the DApps, and therefore need UON for bundle creation and distribution. At this stage, the supply side will be covered by Unova selling UON to companies/organisations. In the next stage, more companies will join the network and Unova will expand towards different industries, beyond the ones initially targeted in the go-to-market. Additionally, different business models are likely to be built on the Unova infrastructure resulting in a rise in the demand for UON to facilitate financial transactions, deployment, and execution of new smart contracts, and whitelisting of Type-1 nodes. All the above will result in a shift of the demand curve, while the (circulating) supply side will not be affected as the Base fee (part of the transaction fee) is initially credited to the Unova wallet. This is further elaborated on in the next section on transaction fees. Moving forward, the aforementioned demand-side effects would continue shifting the demand curve. This effect is strengthened by the implementation of the proof-of-stake (POS) consensus mechanism that allows earning rewards by staking UON. The implementation of a deflationary burning mechanism through the Base fee would result in the circulating supply curve shifting in the opposite direction. Moreover, the size of the shift will be proportional to the number of transactions as a result of the Base fee mechanism. In doing so, there will be an increasing scarcity of the available UON. For companies, however, it is essential that they have predictable pricing (in fiat currency) for data distribution, to leverage the smart contracts and applications within the network. Companies will not introduce new technology to their business if they cannot predict the price of this technology in the coming years. As mentioned before, the UON token acts as the means of transacting within the Unova network, and the price predictability of the transaction fees is an important consideration. So, what happens if the price of the token increases over time or becomes volatile due to ever-changing market conditions? Each organization has a different degree of utility of the technology. This will result in different configurations while using the solution, by comparing the willingness to pay per unit of data[9] distribution (or per transaction for other smart

[9] a unit of data could be a supply chain asset (e.g. a piece of meat) or event (e.g. an inbound transport)

contracts) with the price of a unit of data distribution (or the price for a general transaction to execute the smart contract). To understand the choices to be made, specifically concerning the configuration of the data distribution aspect, the transaction price per unit of data P_u can be defined as

$$P_u = \frac{G_u\left(B_f + P_f\right) + A_f}{B_s} \tag{1}$$

$$B_s = U_d T_p \, min\{x \in \mathbb{N} \mid x\, U_d T_p \geq M_{Bs}\} \tag{2}$$

where, G_u represents the Gas used for a transaction, B_f represents the Base fee of a transaction, P_f represents the Priority fee of a transaction, A_f represents the application fee, B_s represents the bundle size, i.e number of units of data put inside a bundle that is hashed (bundleID) and put inside a transaction. U_d represents units of data creation per second, T_p represents the time period chosen between bundle creations in seconds and M_{Bs} represents the minimum bundle size chosen.

Hence, the configuration decision to be made by organizations, to receive the needed utility relative to P_u[10], will be with respect to the distribution timing ($B_f + P_f$), T_p, and M_{Bs}. The timing of distribution chosen determines whether the creation of the bundles happens when the network is congested (or blocks are full). Creating bundles when the network is less congested results, ceteris paribus, in lower ($B_f + P_f$) in the competitive market for transactions and thus a lower P_u, as can be seen in Eq.(1). The configured T_p determines how often the protocol checks if M_{Bs} has been reached. Choosing a larger T_p results, ceteris paribus, in larger bundles distributed less frequently (as can be seen in Eq.(2).) and thus a lower P_u (as can be seen by substitution of Eq.(2). in Eq.(1).). Under the assumption that U_d results in the number of units of data created in T_p, being smaller than M_{Bs}, reducing M_{Bs} would, ceteris paribus, result in more frequent and smaller bundles (as can be seen in Eq.(2).) and thus a higher P_u (as can be seen by substitution of Eq.(2). in Eq.(1).).Organizations with lower utility needs could decide to make larger bundles and distribute less frequently at times when the network is less congested, for a given production and distribution need. Post making this decision, an organization can determine the time duration for which they wish to set this fixed price (by purchasing x number of UON at once). This dynamic enables companies to take into account potential volatility in UON price,

[10] Please note that only the companies for which this is possible will join the system

expressed in fiat, by covering their need for a certain period and de facto experiencing a stable transaction price. The respective time duration and number of UON purchased by each organization will depend on the level of belief in the utility of the Unova network. There is an early mover advantage, but over time the utility of the solution will also increase as more organizations adopt the technology. Each organization will have a different perception about this, leading to early adopters vs late adopters, with the former expecting to have cheaper prices and the opportunity to fix their price for a long duration, by purchasing large amounts of UON. After the covered time period has passed, the same exercise as explained above will repeat, after which organizations potentially choose a different configuration. Early movers or investors of UON have additional benefits. Even if they don't end up being users of the system, they can still contribute to growing the ecosystem and could potentially benefit from monetary gains. Organizations expanding on the offering (initially for themselves) could also benefit from sharing their newly created DApps or smart contracts with their business partners or other organizations, leading to new revenue streams.

6.2. *Unova transaction fees* — First of all, it should be noted that Unova has used the Ethereum Network as inspiration for the pricing and transaction fee model, and proper credit is hereby given to the Ethereum community [6]. Similar to Ethereum, the Unova network uses the concepts of Gas and Gas price for the execution of transactions. Gas refers to the unit that measures the amount of computational effort required to execute specific operations on the network. Since transactions on the Unova network require computational resources for execution, a fee is charged as a means of fair compensation for these computational services. The amount of Gas of a transaction impacts the required fee to execute a transaction on the Unova network. For example, a standard financial transaction requires 21000 Gas whereas the execution of more computationally heavy transactions, such as smart contracts, would require more Gas depending on the complexity. The transaction fee to be paid for a blockchain transaction is then equal to Gas * Gas price. Gas price (the price for each unit of Gas) is denoted in Gwei (10-9 UON). During the execution of a transaction, the network will determine what the actual ‘Gas used’ is. Therefore, a user willing to execute a transaction (or a smart contract) can use the concept of Gas limit to set a limit. As long as the Gas limit is larger or equal to the Gas used, the transaction will be executed successfully. If the Gas limit set by the user exceeds the Gas used, the remaining part will be paid back to the user. If the Gas limit is set too low, the transaction will fail and the UON could be lost. The Gas price is constituted of a Base fee and a Priority fee. The Base fee is calculated independently of the current block and is determined by the blocks before it, making transaction fees more predictable for users. More precisely:

$$B_f(t) = max\left\{50,\ B_f(t-1)\left(12,5\%\ \frac{G_u(t-1) - \frac{B_l(t-1)}{E}}{\frac{B_l(t-1)}{E}} + 1\right)\right\} \quad (3)$$

where $B_f(t)$ represents the Base fee of block t (in Gwei), $G_u(t)$ represents the Gas used in block t i.e., the total amount of Gas used for all transactions in block t, $B_l(t)$ represents the Block Gas limit of block t i.e., the maximum size of the block, and E represents the Elasticity multiplier i.e., the ratio between maximum and target block size

meaning that:

I. if $G_u(t-1) < \frac{B_l(t-1)}{E}$,

$$B_f(t) = max\{50, B_f(t-1)(12,5\%\, a + 1)\}$$

$$with\ a < 0\ and\ min\{a\} = \frac{0 - \frac{B_l(t-1)}{E}}{\frac{B_l(t-1)}{E}} = -1$$

II. if $G_u(t-1) > \frac{B_l(t-1)}{E}$,

$$B_f(t) = B_f(t-1)(12,5\%\, b + 1)$$

$$with\ b > 0\ and\ max\{b\} = \frac{B_l(t-1) - \frac{B_l(t-1)}{E}}{\frac{B_l(t-1)}{E}} = E - 1$$

III. if $G_u(t-1) = \frac{B_l(t-1)}{E}$,

$$B_f(t) = B_f(t-1)$$

Hence, Eq.(3). shows that with the current parameters, $B_f(t-1)$ decreases by a maximum of 12,5% if the target block size is not met, until a minimum of 50 Gwei. $B_f(t-1)$ increases by a maximum of 12.5% if the target block size is exceeded. This design allows for market dynamics where $B_f(t-1)$ is automatically adjusted when $G_u(t-1)$ is larger (or smaller) than its target block size to avoid congestion and long execution waiting times. The aim is to have $G_u(t)$ approach the target block size. Whenever the network gets too congested, $B_f(t-1)$ increases which incentivizes users to execute transactions when blocks are closer to their target block size (and thus at lower Base fees). If $G_u(t-1)$ is below its target block size, $B_f(t-1)$ decreases, incentivizing more users to execute their transactions at this time. These dynamics lead to transactions being spread evenly throughout the day (or between all blocks) and thus all blocks being equally utilized. When the block is mined, this Base fee will currently be credited to the Unova wallet removing it from current circulation. This allows Unova, in an initial phase, to use these Base fees to fund development within the Unova community. Later this will change, and the Base fee will be "burned", permanently removing it from circulation. This would create deflationary pressure on the token supply and inflationary pressure on the price of the UON token. Next, a Priority fee (or tip) for miners can be set. If transactions need to get preferentially executed ahead of other transactions in the same block, a higher tip can be given to attempt to outbid competing transactions. The tip also incentivizes miners to include transactions in the block and avoids the creation of empty blocks by miners. Since the user does not set the Base fee but can set a Priority fee, and the Base fee is variable between blocks, the user can set a 'Max Fee' representing the maximum total Gas price for his transaction. Lastly, the smart contracts, as part of the Unova DApps, have an additional value 'Application fee' added to the transaction fee, which is a reward for developers within the Unova ecosystem. These smart contracts are executed by the Type-1 nodes and could, for example, be used for data distribution between supply chain stakeholders.

6.3. *Block reward* — The block reward is the number of UON that is rewarded each time a block is successfully mined. This creates appropriate incentives for the network to reach sufficient decentralization by rewarding miners for providing their computational service. The block reward is given regardless of the number of transactions within the block. This mechanism would incentivize miners in the initial stages when Priority fees (or competition for block space) might be lower. Therefore, the block reward is at its highest in the initial stage and practically phases out when the Unova network grows. More specifically, consider :

$$i = \left\lfloor \frac{B_n}{6311836} \right\rfloor + 1 \quad (4)$$

$$where \ \lfloor x \rfloor = max\{ n \in \mathbb{Z} \mid n \leq x \}$$

then

$$B_r(i) = \frac{6}{2^i} \quad (5)$$

where i represents the reward period, B_n represents the block number, and $B_r(i)$ represents the block reward in reward period i.

Note that in the above setup, the block reward diminishes over time. More precisely, consider an average block time of 5 seconds and each year to be 31 556 926 seconds, then substitution of Eq.(4). in Eq.(5). shows that the block reward is approximately halved every year, allowing for the maximum supply of UON still to be capped at 319 118 316 (as can be seen in Eq.(6).).

$$T_u(k) = 281\ 250\ 000 + \sum_{i=1}^{k} 6\ 311\ 386\ \frac{6}{2^i} \tag{6}$$

where $T_u(k)$ represents the total UON at the end of each kth (k $\in \mathbb{N}$) reward period.

$$Hence\ for\ k \to \infty$$

$$T_u(k) = 281\ 250\ 000 + 37\ 868\ 316\ \frac{\frac{1}{2}}{1-\frac{1}{2}} = 319\ 118\ 316$$

$$where\ it\ is\ used\ that\ for\ |a|<1,\ \sum_{i=1}^{\infty} a^k = \frac{a}{1-a}$$

The block reward dynamics throughout time are visualized in Figure 4 below.

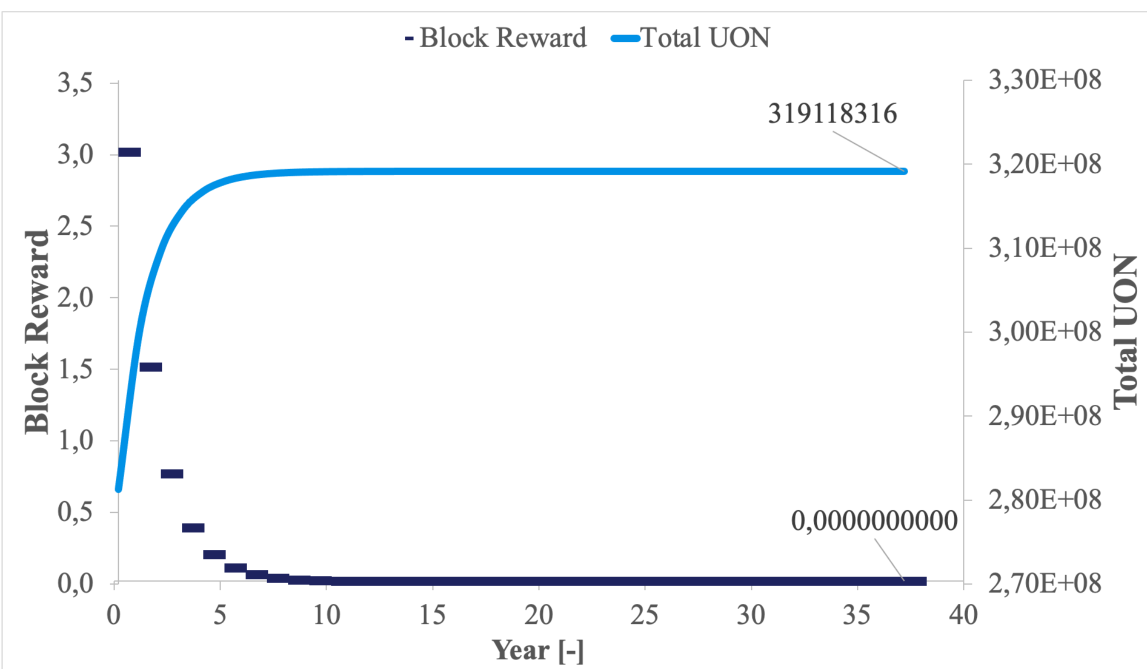

Figure 4: Block Reward Dynamics

It should be noted that the implementation of a deflationary mechanism through increased transactions could result in a lower total supply. All parameters described above are chosen to reach the desired level of decentralization by considering the cost-to-benefit ratio of the miners. Note that the used consensus mechanisms (initially POA and later POS) are relatively computationally light and thus less costly for miners to execute transactions. In addition to incentivizing decentralization, the block reward is likely to serve as a tool to guarantee sufficient market liquidity as miners are more likely to sell their block rewards as they have to maintain their operational expenses, as opposed to investors who may hold UON token for a longer period. However, there is no way to know with sufficient certainty whether the miners receiving this block reward will hold these tokens or sell them in exchanges. Therefore, abstraction is made of the block reward in the discussions above.

7. Pilot Cases - Platforms & DApps

DApps have their backend code (smart contracts) running on a decentralized network (Unova-Mainnet) as opposed to a centralized server. They use the Unova blockchain for data storage and smart contracts for their application logic. A smart contract is like a set of rules that is live on-chain for all to see and run precisely according to those rules. Imagine a vending machine: if you supply it with enough funds and the right selection, you'll get the item you want. And like vending machines, smart contracts can hold funds much like your Unova account. This allows code to mediate agreements and transactions. DApps can be decentralized because they are controlled by the logic written into the contract, not an individual or a company. In what follows some readily available DApps as part of Unova's platforms are highlighted.

7.1. Hubwatch Onboarding platform — The Onboarding platform contains all the steps and information for any organization to join the supply chain system. It is low code; hence, designed to be user-friendly and efficiently deployable. In what follows, some capabilities are highlighted in Table 3.

Table 3: Onboarding platform capabilities

[1] Create a wallet	Creating a wallet allows users to read their balance, send transactions, and connect to applications. Wallets are a tool for managing Hubwatch accounts. That means users can swap wallet providers at any time. Many wallet providers allow managing several Hubwatch accounts from one application.

[2] Launch a node	To enable easy onboarding, the node types can be installed on a server with one single command line in the terminal after which whitelisting can happen. This together with an entire user-friendly onboarding platform allows the frictionless onboarding and introduction of the technology to any company without prior blockchain knowledge.
[3] Add facilities	During the signup flow, users receive their own private and public keys for the Blockchain system. These are the main keys and will be linked to the account owner's admin panel with billing and other admin functions. Using the main keys, the account owner will be able to add multiple facilities. Each facility will have its own private and public key assigned, which is in a lower hierarchy and linked to the account owner's key pair.
[4] Manage access	The 'Users & Roles' module allows adding people to onboard an organization, with each their own responsibilities. Some roles will receive their own private and public key, which will be linked to the facility keys.
[5] Map the company's internal process	The purpose of the Hubwatch Chain builder is to help visualize, understand, and create the events (or asset creations) that will occur inside a company. This tool can also be considered as a settings page that will be used in other aspects of the Hubwatch platform and impact the API. It is thus important the users take care when building a company's chain and be accurate concerning the settings they select.
[6] Invite supply chain business partners	Hubwatch creates more value the more suppliers and customers of a company are onboarded to the system. Hubwatch thus encourages companies to sit together with their suppliers and customers and invite them to join the Hubwatch ecosystem. Companies can simply invite them to join via email. If their supply chain partner is already part of the ecosystem, they can simply add them to their partner list. By having more supply chain partners onboarded, companies will notice their traceability score increase.

[7] Increase the company's traceability score	Traceability and the added benefits of obtaining this should be rewarded as it brings value to business partners as well as governments, consumers, and even the environment. This led to the creation of the traceability score. The score is based on the percentage of assets that can be traced back and the percentage of assets that can be traced forwards. Therefore, it indicates a combination of how many suppliers of this company provide data about the products going through its supply chain, as well as how many customers continue this going forward. A score of 100 means all suppliers and all customers of this company are a member of the ecosystem and create digital entities of all the products they produce, signaling good practices and a transparent, trustworthy producer. Conversely, a score of 0 means the opposite.

7.2. Hubwatch Main platform — Hubwatch main platform allows companies to view data, trace any product, execute recalls, do demand predictions, and much more. In what follows, some capabilities are highlighted in Table 4.

Table 4: Main platform capabilities

[1] Hubwatch trace	In many cases, it will be important to be able to trace any product and in an intuitive user-friendly way visualize the full chain of this product. Data is only data and lacks value until it can be used and is used to make decisions. The Unova trace module serves exactly this purpose.
[2] Recall system	When things go wrong, and a product is contaminated, what can you do? We purposely wrote "when" and not "if" because we all know that sometimes, things go wrong and the only thing left to do is resolve the issue. The Hubwatch recall system is designed to do just that. Just select an asset or multiple assets that caused a problem, and the system will take care of the rest. Organizations that are involved will be notified and assets recalled before it turns into a problem.

[3] Insights/analytics	Gain insights into every corner of your supply chain. Notice supply chain inefficiencies, spot problems, analyze in seconds how long a product is spending time at each step, average dwell time, time since harvest, and much more. Giving you more certainty and control over the quality of your product.
[4] Counterfeit monitoring & flagging scripts	Monitor your partner's supply chain data for a potential counterfeit activity or abnormal activity. Automatic flagging scripts run on the data, allowing immediate insight into possible label counterfeiting or gaps in supply chain monitoring. Rules can be added to the asset & event creations limiting the possibilities for counterfeit data creation.
[5] Inventory management & demand predictions	Reduce the bullwhip effect and working capital requirements which impose risks for supply chains by improving demand predictions based on customer and supplier production data and inventory status.
[6] Open read APIs	Although the applications provided by Unova already give access to many insights, the read APIs allow organizations to integrate the data directly into their existing systems.

7.3. *Hubwatch Consumer tracing* — Share full supply chain transparency and proven traceability with the end consumer via a mobile-friendly web app. Hubwatch consumer trace dashboard allows the consumer to scan a QR-code/barcode on a physical product and get access to full traceability and transparency data. This will enable consumers to view, rate, comment, share or store products and view all members in the ecosystem. Aside from traceability and other insights, this application also notifies whenever there is a chance the product is counterfeit based on the various data points captured.

7.4. *Scaling the Web3 vision* — The true value of the smartphone was unlocked when the app store was launched which pointed people to opportunities in creating apps and building entire business models. These newly created apps increased the value of the smartphone as the backbone infrastructure, enriched our lives, and solved many problems. In a similar fashion to the Apple app store controlling the distribution of apps in a centralized Web2 way, the Unova infrastructure creates a decentralized Web3 operating system for blockchain applications and solutions. To promote the usage, utility, and availability of these solutions, Unova envisions a platform that allows users to find extensions, applications, protocols, smart contracts, and tools that are built on or leverage the Unova network and its nodes. This platform will be built in a web3 fashion with a basis of smart contracts and wallet authentication. The applications that are promoted through this web3 application store need to follow standards and rules to maintain compatibility and comply with principles set by the ecosystem. By creating a place where both creators and users can come together to promote and find the technologies which bring their blockchain operations to a higher level, the following is achieved:

[1] Network effects and mass adoption of the technology are promoted and fueled.

[2] The general utility of the UON token is increased as the smart contracts and business models that leverage are paid in UON.

[3] More developers, entrepreneurs, and visionary community members are attracted and incentivized to start building on the network.

[4] An open innovative culture is provided, which benefits the overall production and supply chain industry resulting in better products, operations, and standards for everyone.

8. Future potential 3rd party solutions

Unova-Mainnet, its smart contracts, protocols, and data flows provide the right basis for additional services and a potential for a whole new production model. In this section, some initial ideas[11] for future developments are outlined.

8.1. DeFi Solutions

The data infrastructure created by Unova paves the way for many additional financial solutions built into smart contracts. Potentially, DeFi could become one of the most significant application types built on Unova. While many existing DeFi systems are limited to crypto-native assets and closed financial loops, Unova enables decentralized financial solutions that can operate on verifiable real-world data, while maintaining privacy, auditability, and decentralization. Unova provides the core infrastructure required for financial logic to be executed in a trust-minimized environment, without relying on centralized data providers, custodians, or intermediaries. A large portion of the global economy operates with limited access to formal financial services. The barriers are not limited to capital availability, but extend to structural limitations such as:

[1] Lack of reliable financial and operational data

[11] Mark that what follows are initial descriptions and future research will provide more details.

[2] Inconsistent or non-existent accounting standards

[3] Limited banking and credit infrastructure

[4] High counterparty and verification risk

[5] High costs of compliance and enforcement

These constraints prevent many individuals and organizations from accessing loans, insurance, investments, and other financial instruments, even when they generate real economic value. Unova can address these challenges by enabling trusted data flows and programmable financial logic through smart contracts. At the core of Unova's value proposition for DeFi is its data infrastructure. Unova enables; secure generation of structured data; cryptographic verification of data integrity; selective and privacy-preserving data sharing; and on-chain coordination of off-chain data. This infrastructure allows decentralized applications to base financial logic on both; live [active], real-world events and historical performance and behavior data. As a result, financial agreements can be automated based on verifiable facts rather than subjective reporting or centralized validation. Unova does not rely on traditional third-party oracle networks to bridge on-chain and off-chain data. Instead, Unova's architecture allows first-party data producers to act as native data providers. Data integrity is anchored on-chain through cryptographic hashes, while the data itself remains under the control of its originator.

This approach:

- Reduces reliance on centralized oracle providers
- Minimizes data manipulation risk
- Improves transparency and auditability
- Preserves data privacy

Smart contracts can consume this data directly, enabling deterministic and trust-minimized execution.

Unova-Mainnet positions smart contracts as foundational financial infrastructure by allowing any third party—including financial institutions, developers, and entrepreneurs—to deploy programmable logic that governs financial activity. These smart contracts can evaluate conditions based on incoming data, automatically execute payments or settlements, enforce contractual terms, reduce operational and counterparty risk, and enable entirely new financial products. Because Unova operates as an open blockchain, innovation is not constrained to a single financial model or institution, allowing diverse approaches to coexist and evolve.

A broad range of decentralized finance use cases can be deployed on Unova. In trade financing, smart contracts can provide funding based on verified production or delivery events, reducing reliance on intermediaries while improving access to capital. In insurance, parametric contracts can automatically trigger payouts based on verifiable real-world events, significantly reducing claims processing time and fraud risk. Loan agreements can be executed through smart contracts that assess risk using historical and real-time data, enabling access to credit without traditional collateral structures. Unova also supports investment mechanisms in which capital allocation and returns are governed by transparent, rule-based smart contracts informed by trusted data.

Additional financial applications include factoring and invoice discounting, where receivables can be tokenized and financed based on immutable records and confirmed events, improving liquidity and lowering verification overhead. Unova further enables decentralized commodity and asset markets in which pricing, settlement, and ownership transfers are enforced directly through smart contracts, increasing efficiency and trust across market participants.

A defining characteristic of Unova is its commitment to open financial innovation. DeFi solutions are not embedded within or controlled by the protocol itself; instead, any third party can build and deploy financial applications, multiple competing financial models can operate simultaneously, and users retain sovereignty over their data and assets. This open architecture ensures long-term adaptability and continuous innovation.

By combining decentralized smart contracts with trusted data infrastructure, Unova enables financial systems that are more inclusive, more efficient, more transparent, and more resilient. The result is a blockchain infrastructure capable of supporting decentralized finance not only within crypto-native environments, but across the real economy at large.

8.2. Decentralized AI automation

There is growing discussion around the possibility of AI systems managing increasingly complex parts of the economy. While advances in artificial intelligence are significant, the primary limitation to large-scale AI-driven coordination is not the intelligence of algorithms, but the availability, reliability, and structure of data, as well as the ability to execute decisions across multiple independent actors.

In decentralized environments, AI systems face two fundamental challenges:

- Access to trustworthy, real-world data across organizational boundaries
- The ability to translate decisions into actions without centralized control

Unova-Mainnet addresses both challenges by providing a decentralized data and execution infrastructure upon which AI-driven automation can operate.

Unova is not an AI platform and does not train models, perform inference, or define decision logic. Instead, it can serve as the foundational infrastructure that enables AI systems to function in decentralized environments. Unova supports structured and verifiable data generation, privacy-preserving data aggregation across organizations, immutable data lineage and provenance, and smart contract execution for automated decision enforcement. This allows AI systems—developed and operated by third parties—to interact with real-world data and execute outcomes in a trust-minimized manner.

Effective AI systems require not only large volumes of data, but data that can be trusted. Unova ensures that data is generated by first-party sources, that its integrity is cryptographically verifiable, that historical records remain immutable and auditable, and that access is governed through permission controls. These properties produce datasets suitable for optimization models, predictive analytics, automated planning systems, and decision-support algorithms. AI systems can consume both live data streams and historical records, enabling continuous learning and iterative improvement.

A critical limitation of many AI deployments is the gap between decision-making and execution. In centralized systems, execution often depends on human intervention or proprietary platforms. Unova bridges this gap by enabling AI systems to trigger smart contracts that execute predefined actions, enforce rules and constraints, coordinate outcomes across multiple parties, and maintain transparency and auditability. This capability transforms AI from a passive advisory tool into an active coordination mechanism while preserving decentralization and accountability.

In the near term, Unova enables practical AI-driven automation that emphasizes data aggregation and automated execution rather than advanced general intelligence. For example, AI systems can analyze real-time availability, pricing, and capacity data to automatically book transport services, with smart contracts executing bookings, confirming commitments, and settling payments without intermediaries. Automated purchasing systems can monitor consumption patterns and trigger orders based on predefined thresholds, predictive demand models, or contractual obligations, with smart contracts ensuring transparent placement and confirmation. AI-driven inventory management can optimize stock levels using historical usage, real-time availability, and demand forecasts, reducing overstocking, shortages, and working capital requirements. Similarly, delivery time optimization can combine historical performance data with live updates to dynamically adjust schedules, while smart contracts enforce incentives, penalties, or rerouting decisions based on actual outcomes.

For AI-driven automation to gain adoption, participants must trust both the data inputs and the decision-making process. Unova facilitates this trust by ensuring that decision inputs are verifiable, execution rules are transparent, outcomes are auditable, and no single party exercises unilateral control over the system. These properties increase the likelihood that organizations will adopt and act on AI-generated decisions, even when those decisions affect multiple independent stakeholders.

Over the long term, Unova provides the foundational infrastructure for increasingly autonomous, decentralized AI systems capable of coordinating complex economic activity. Such systems can continuously evaluate real-world data, propose or execute optimizations, operate within transparent rule sets, and remain accountable through immutable records. The progression toward AI-managed economic coordination depends not on centralized control, but on decentralized data availability and decentralized execution—capabilities that are intrinsic to Unova's design.

8.3. Non-Fungible Token (NFT) service-based production

Generally the production industry is organized in a way where companies purchase raw materials, store them as inventory, process them and sell the newly produced goods to the next step in the supply chain. Each step in this sequence pays the supplier first and then waits to get paid by the customer requiring large working capital to cover the period. In addition, companies often require additional financing to be able to purchase the raw materials in the first place and more capital to expand the operations. The performance of such a business model could significantly increase when the model is changed from a buying and selling model into a service model where the company does not purchase the raw materials but performs the service of processing instead. So why do most companies not operate in such a way? In what follows a few reasons are highlighted:

- There is no marketplace for raw materials or inventory investing[12];
- There is no data availability to make smart investments (no asset creation data or event registrations containing sufficient publicly available or auditable data);
- There is no infrastructure guaranteeing further processing into the final product is rewarded (Automated payments).

In what follows, a possible future is described where the aforementioned elements become available. In this scenario, it is assumed that companies create digital entities of products, assign events and distribute this data to multiple stakeholders by leveraging Unova-Mainnet. As most data distribution still happens off-chain yet maintains auditability by design, they are not all created as NFTs. The reasoning is to allow for scalability and privacy as outlined in previous sections thus using the unova distribution protocol. However, when a company wishes to change into a service model, it will create NFTs which link back to the vast amount of data already available about these products. Two possible scenarios are:

- There is a marketplace where anyone can purchase and invest in these products.
- Nobody actually purchases the NFTs until the end consumer does the purchase.

In the first option, anyone would be able to purchase a product going through a supply chain. Whenever the next company does some action to process the product, this company will be

[12] Note that there is a commodity market for selling grains, coffee, etc,.. and other commodities pre-season but no real accessible (NFT) market for specific inventories or individually sold products going through the chain.

automatically paid by the NFT contract. In the future, it could be that the processing machines have their own wallet and thus get paid for their actions. The final consumer of the final step in the supply chain that no longer wishes to have a service model (for example retailer) will then purchase the NFT ready for a real-world sale. This can all be fully automated and should not be seen as a manual process. In the second option, all producers who had a hand in creating the item get paid according to their contribution to the final product, when the purchase happens by the end consumer. This option sounds more futuristic as it implies consumers would purchase UON to buy a physical product. However, the consumer product as described in 6.3 consumer tracing and the fact the retailers would be part of the system increases the feasibility.

9. Conclusion

The L1–L2 hybrid architecture of Unova-Mainnet, its built-in smart contracts, privacy-enabled data distribution protocol, and open application layer together form a comprehensive solution to many of today's coordination, trust, and automation challenges across the digital and real economy.

By dramatically reducing the friction required to participate in a Web3 network, Unova is positioned for broad adoption and long-term economic value creation. Organizations retain full sovereignty by hosting their own nodes, applications, and data, while still benefiting from shared, verifiable state and decentralized execution. This balance between autonomy and coordination forms a durable foundation for continuous innovation.

Unova's open and decentralized design enables a growing ecosystem in which developers, enterprises, institutions, and innovators become direct stakeholders and contributors to the network. The crypto-economic model aligns incentives across all participants, ensuring security, sustainability, and the democratization of both infrastructure and value creation.

Rather than prescribing a single use case or industry, Unova enables the emergence of new business models, decentralized financial systems, programmable payments, data-driven automation, and applications yet to be imagined. As adoption expands, Unova evolves into a neutral, global coordination layer for trusted data, decentralized logic, and economic interaction.

The end goal: **Unova as a foundational Web3 infrastructure powering the next generation of digital and real-world systems.**

Notes and References

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