dHealth Protocol: A Trustless Healthcare Network for Humans, Providers, and Machines

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Abstract. The dHealth Protocol links real-world events to digital proof, anchoring trust in cryptographic verification rather than centralised systems. It is a trustless coordination layer for healthcare and adjacent domains, enabling verifiable proof of what happened, who acted, and under what authority, without storing raw health data on-chain. The protocol is built on four primitives: **cryptographic credentials** for individuals, organisations, and machines; **schemas** that define attestation meaning; **attestations** as signed claims about actions or states; and **mandates** as explicit, revocable delegations of authority. Together, these provide portable, audit-ready proof of healthcare actions across institutional boundaries. The protocol separates meaning from money: primitives define accountability, whereas payments and reimbursements rely on stable-value assets. The dHealth Protocol token (DHP) is a participation and accountability asset, locked to back identities, issuance rights, and attestations. Designed for continuous care, research, and machine participation, the protocol supports high-frequency, low-latency attestations on production-grade infrastructure, with DHP inflation controlled at a 2% annual rate to fund sustainable operations.

Version: 0.1 (living draft), parameters may change via governance.

1. Introduction

Healthcare is increasingly delivered through networks of patients, clinicians, insurers, laboratories, AI systems, and connected devices. Despite this shift, coordination among these actors still depends on trust-intensive artefacts such as portals, PDFs, and vendor-controlled logs, which do not provide verifiable integrity across institutional boundaries. As a result, proving that an action occurred, who performed it, and under what authority remains slow, fragmented, and fragile, particularly in continuous and machine-assisted care settings.

The dHealth protocol addresses this coordination gap by introducing a credential-based framework for verifiable healthcare actions that does not require centralising sensitive health data. At its core, the protocol defines 1) **cryptographic credentials** for individuals, organisations, and machines; 2) shared **schemas** that define the meaning and validation rules of attestations; 3) **attestations** as signed claims that an action or state occurred; and 4) **mandates** as explicit, revocable delegations of authority to act or attest under defined conditions. Together, these primitives enable audit-ready proof of action for both humans and machines, creating portable, privacy-preserving evidence of a person's health journey that can be verified independently across systems, organisations, and time.

The protocol deliberately separates meaning from money. Credentials, mandates, and attestations define who acted, under what authority, and what occurred, while payments and reimbursements use

stablecoins to support predictable real-world costs. DHP functions as the protocol's participation and accountability asset rather than a payment token, and is locked to support identities, issuance rights, and attestations, aligning responsibility with long-term commitment. DHP has no fixed supply cap and inflates at a controlled 2% annual rate to fund sustainable development and operations, with inflation directed toward productive participation rather than passive yield. By anchoring trust in cryptographic proof rather than in centralised or vendor-controlled systems, the dHealth Protocol provides a human-centric, machine-readable foundation for verifiable healthcare actions at scale.

2. Motivation and Problem Definition

Healthcare has shifted from episodic encounters to continuous, multi-actor workflows. The bottleneck is no longer generating information, but proving that actions were taken **with valid authority**, while preserving privacy and keeping responsibility attributable to humans. The protocol replaces document-centric trust with verifiable, portable evidence of care-relevant actions.

The protocol is designed to address four structural problems in modern healthcare coordination. First, it replaces trust-based artefacts such as PDFs, portals, and unverifiable logs with cryptographic proof that an action actually occurred. Second, it enforces explicit authority by ensuring that every action is attributable to a verifiable credential and, where required, a clearly defined mandate. Third, privacy is guaranteed by architecture: no personal or medical data is stored on-chain, only cryptographic proofs, references, and revocation states. Finally, the protocol enables human-first machine participation, allowing AI systems and robots to act and attest only under explicit, revocable mandates issued by accountable humans or institutions.

3. dHealth Network Legacy

dHealth has migrated its architecture to ensure its primitives, such as credentials, authorisation, and verifiable actions, can be enforced natively. Before Cosmos, the network used Symbol, but limited smart contracts constrained programmable authorisation. Cosmos enabled flexibility via an app chain, but continuous-care workloads exposed the cost of running a standalone chain: operational risk and diverted resources. The current transition sunsets the Cosmos app chain and migrates DHP plus attestation/mandate services to **Solana** for high-frequency, low-latency execution. Post-migration, DHP is defined as a protocol-layer accountability asset, while payments are made using stablecoins.

4. Objectives

Using the protocol, any verifier can independently confirm that an action occurred, who claimed it occurred, and, where applicable, who verified it. The protocol builds on the Solana Attestation Service[1]. It relies on attestations and identity credentials rather than on vendors, portals, bilateral trust, or proprietary databases.

4.1. Establish Verifiable Credentials for All Actors

The protocol aims to provide a unified identity and credential layer for all actors participating in healthcare workflows. An Identity Credential represents a participant in the network and anchors the identities of those authorised to act, to issue attestations, and to delegate authority to others. Credentials apply equally to individuals such as patients, caregivers, and researchers; to organisations

[1] https://attest.solana.com/docs

such as hospitals, laboratories, NGOs, and insurers; and to machines, including AI agents, robots, and connected devices. Creating a credential incurs a small, stablecoin-based fee to cover network rent and execution, and is accompanied by a locked DHP commitment that represents long-term accountability.

4.2. Define Shared Meaning Through Schemas

To ensure that attestations are interpretable across systems, organisations, and applications, the protocol introduces schema credentials. A schema defines the meaning of an attestation by specifying the type of action or state being claimed, the required and optional fields, references to supporting evidence, and the verification expectations. Schemas act as shared, public definitions that make attestations reusable and comparable across contexts, such as vaccination records, weekly outcome reports, or device-generated measurements.

4.3. Enable Verifiable Proof of Action via Attestations

At the core of the protocol is the ability to issue attestations: signed statements that an action or state occurred. Each attestation answers three fundamental questions: what happened, who claims it happened, and, where applicable, who verified it. An attestation can reference a schema, a subject identity, optional off-chain evidence, and an optional mandate under which the action was performed.

Attestations are immutable once issued, but revocation-aware, meaning they can be invalidated without being erased. This preserves audit trails while allowing corrections. Attestations are designed to be auditable across organisational boundaries without requiring shared databases or vendor trust.

Attestations reference evidence through cryptographic commitments, while access control is handled off-chain. Raw healthcare data is never stored on-chain; evidence remains with individuals, institutions, or decentralised storage, and is verified by matching the hash of the original commitment. The protocol provides a universal integrity anchor, while encryption and sharing are managed by the application or wallet.

4.4. Enforce Explicit Authority Through Mandates

The protocol explicitly separates the ability to act from the authority to act by introducing mandates as a special type of attestation. A mandate delegates authority by defining who is allowed to act, on whose behalf, for which actions, for what duration, and under which constraints. Mandates are essential for AI agents acting on behalf of patients, robots performing care or rehabilitation tasks, and organisations operating under regulatory or contractual authority.

Each mandate is explicit, time-bound, revocable, and independently verifiable by any third party. By making authority a first-class, verifiable object, the protocol ensures that machine and institutional actions remain traceable to responsible human principals.

5. Participation Deposits and Fee Model

The dHealth Protocol requires all participants, humans, organisations, AI systems, and robots, to make a time-limited DHP deposit to participate. This deposit serves as a **participation bond**, ensuring commitment, preventing spam, and aligning incentives, while remaining fully reclaimable. Amounts are denominated in stablecoins to ensure predictability and can be adjusted through governance.

5.1. Individual Participation

Individuals participate in the protocol by locking DHP with an approximate countervalue of USD 15 for a minimum of 90 days. The locked DHP always remains the individual's property and can be fully reclaimed at market price once the lock period has elapsed. The unlock time is seven days. If the lock is withdrawn, the individual's participation in the protocol ends immediately. Maintaining this lock enables credential creation, receipt of attestations, and access to protocol workflows, ensuring a minimal yet meaningful economic commitment while keeping participation accessible to end users.

5.2. Sponsored Participation by Organisations

As an alternative to individual deposits, an organisation may lock DHP corresponding to a countervalue of USD 15 on behalf of an individual user. In this case, the DHP remains owned and reclaimable by the organisation, allowing the individual to participate in the protocol without directly handling tokens. This model is intended for use cases such as research studies, care programs, NGO initiatives, or institutional onboarding, and shifts economic responsibility upstream while keeping participation friction low for individuals.

5.3. AI Agents and Robots

AI agents and robots participating in the protocol must be backed by a locked deposit of DHP corresponding to a countervalue of USD 10, which must be maintained for at least 90 days. This deposit ensures that machine actors operate under accountable economic constraints and is locked by the responsible operator, such as a manufacturer, service provider, or owner. The locked DHP remains reclaimable after the required lock period; however, unlocking the DHP terminates the machine's participation in the protocol when the DHP are refunded..

5.4. Organisational Participation

Organisations must lock **USD 500 worth of DHP** to participate in the protocol.

This deposit enables organisations to:

- issue and receive attestations,
- sponsor individual users,
- operate AI agents or robots,
- and earn from protocol-mediated transactions.

The organisational deposit reflects the higher responsibility and impact of institutional participation while remaining modest relative to real-world operating costs. This lock must be maintained for at least 180 days. However, the lock's withdrawal immediately terminates the organisation's participation in the protocol.

5.5. Initial Payment Fees

At the time of the initial DHP locking, when the USD-denominated payment is made, an additional 10% fee is charged to cover protocol fees. These fees are converted into SOL and directed to a shared fee pool, which is used to cover account rent and onboarding costs on Solana, including the initial rent required when DHP is transferred to a new user or organisation account. This approach ensures that participants are not burdened with blockchain-specific operational complexity.

5.6. Transaction Costs and dHealth Lab Pool

Each protocol action, including credential creation, schema registration, attestations, and mandates, incurs a fixed operational cost of USD 0.10 per transaction. These fees are paid into a dedicated dHealth Operations pool, which is used to cover Solana transaction fees and other ongoing protocol operational expenses. This approach ensures predictable and transparent cost recovery without introducing variable or speculative fees.

5.7. Design Rationale

This participation and fee model achieves several objectives simultaneously:

- It introduces **mandatory demand** for DHP without large financial barriers.
- It prevents spam and Sybil attacks through time-bound economic commitment.
- It allows **sponsored participation**, keeping the system accessible.
- It ensures that operational costs are sustainably covered.
- It cleanly separates participation collateral (DHP) from payments in stablecoins.

Participation in the dHealth Protocol requires a small, reclaimable DHP deposit that scales by actor type. Individuals, organisations, AI systems, and robots all participate under the same principle: **commit DHP to act, reclaim it after participation**. Fees are collected transparently to cover infrastructure and operational costs, ensuring the protocol's long-term sustainability while keeping entry barriers low and incentives aligned. The fee structure, required DHP lock amounts, and other economic parameters are governed by the protocol and may be updated through community governance decisions.

6. Application Areas

The protocol is domain-agnostic but designed to support a range of real-world use cases. Insurers can use it to enable **outcome-based reimbursement** models based on verifiable actions rather than reported activity. Donors and NGOs can rely on it for **outcome-linked donations**, in which funding is released only when agreed-upon milestones are independently verified. Regulators benefit from **tamper-proof audit trails** that allow oversight without access to raw or sensitive data. Researchers can produce **reproducible, verifiable evidence** to support transparent studies and cross-institutional validation. Individuals can also participate directly through self-attestations, contributing verifiable records of actions or states, such as **data sharing** or **study consent**. Across all application areas, the protocol provides evidence of an action, not opinions, interpretations, or raw data.

7. Protocol Token Utility (DHP)

DHP is the protocol asset for participation, accountability, and governance, not day-to-day payments. Stable-value assets handle commerce and reimbursements. Only Solana-native DHP is canonical; wrapped tokens elsewhere do not govern or inflate.

7.1. DHP as access and membership

DHP locking gates access to protocol-grade capabilities, including credential creation, higher-assurance features, and issuer-tier eligibility. Onboarding may be sponsored by clinics, insurers, or employers, ensuring that individuals are not required to purchase tokens directly.

Healthcare providers can reference a participant's level of accountability, as reflected by their locked DHP, when granting access to specific services or workflows.

7.2. DHP as "Proof-of-Prevention" reward

DHP can be positioned as a reward for verified prevention and compliant longitudinal participation (milestones attested by credible issuers, corroborated by devices, or other governance-defined methods). Machines can also accrue rewards for consistent mandate-compliant performance.

7.3. Disputes and accountable issuance

Because attestations can trigger downstream consequences, their issuance may require stake-backed commitments. Bonded DHP provides an enforcement mechanism for disputes and penalties, including cases involving machine actors with real-world operational consequences.

7.4. DHP as governance and voting power

DHP governs schema upgrades, parameters (locks/tiers/slashing), treasury spending, and safety procedures. Governance is conservative and anchored to Solana to avoid fragmented legitimacy.

8. Tokenomics and Inflation

Post-migration, Solana-native DHP has **2% annual inflation** and no hard cap. The intent is predictable long-horizon funding and incentives aligned with productive participation; inflation is not passive yield. The 2% rate is described as broadly comparable to long-run annual increases in global gold supply from mining (as a "low-drift" baseline).

8.1. Supply policy

The initial supply post-migration is 1'850'000'000 DHP. The protocol targets a constant annual growth rate r = 0.02; thus, the supply grows as S(t) = S(0)(1 + r) ^t. In practice, inflation is emitted quarterly to preserve the same annualised rate. This makes issuance controlled and predictable, despite the absence of a hard supply cap.

8.2. Productive distribution, not passive yield

Protocol inflation is distributed quarterly and allocated exclusively to active participants. The annual inflation amount is split into four equal quarterly tranches. Each quarterly tranche is then divided into two equal parts: one allocated to individuals and machines, and the other to organisations.

Fifty per cent of each quarter's inflation is distributed to individuals and machines that have maintained the required DHP lock continuously for at least 90 days. This allocation is distributed across all eligible individuals and machines, weighted by their verified activity during the quarter. Activity is measured by the number of attestations associated with the individual during the quarter. As a result, individuals who contribute more verifiable actions receive a larger share of the quarterly distribution, while passive holders receive none.

The remaining 50% of each quarter's inflation is distributed to eligible organisations. This organisational allocation is divided among organisations based on two measurable contributions during the quarter: (i) the number of attestations issued or verified by the organisation, and (ii) the number of individual participants onboarded by the organisation. Organisations that produce more

verifiable protocol activity and onboard more individuals receive a proportionally larger share of the quarterly distribution.

The precise weighting between attestations and onboarding within the organisational allocation, as well as the eligibility thresholds and lock durations, are protocol parameters subject to community governance and may be adjusted by vote.

8.3. Why locking is central

The economic thesis is acquire-and-lock, not spend. Adoption increases institutional operational locking, reducing circulating supply; onboarding can shift acquisition upstream to issuers.

8.4. Canonical inflation and governance on Solana

Solana is the canonical chain for protocol state, governance, and inflation. All authoritative locks, tier bonds, and eligibility for inflation are defined by the Solana-native DHP state, and governance rights are derived only from the Solana-native DHP. Any wrapped or bridged representations on other chains, including a potential future distribution layer on BASE, are explicitly non-canonical. They may improve access and liquidity, but they remain fully backed by Solana-native DHP and do not fragment “supply, governance, and protocol integrity.”

In practical terms, this means inflation is minted only against the Solana-native DHP supply, and governance decisions are made only by Solana-native DHP holders under the protocol’s voting rules. Wrapped tokens on other chains are representations for convenience; they do not independently increase supply, and they do not confer protocol governance power.

8.5. Long-horizon rationale

The controlled 2% inflation rate is chosen to be small, predictable, and sustainable, reflecting gradual expansion aligned with real network usage rather than speculative issuance. The proposal frames inflation as a mechanism that scales incentives with increasing healthcare activity volume and maintains the system's resilience over decades, whereas a rigid fixed cap could undermine adaptability and long-term security.

9. Governance

Governance is treated as a safety system: it changes rules affecting privacy, authorisation, dispute procedures, tier definitions, and token parameters. Solana is the single source of truth; wrapped tokens do not vote or define canonical locks. Governance uses timelocks for review and includes constrained emergency controls for severe vulnerabilities. Treasury funds public goods (core dev, audits, integrations, dispute infra, adoption). Issuer tiers and machine constraints are governed to preserve the human-first principle: machines act only under explicit, traceable authority.

10. Conclusion

The dHealth Protocol is a trustless coordination layer for healthcare where actions can be proven without vendor databases, bilateral trust, or unverifiable documents. It reduces cross-institutional coordination to independently verifiable primitives: identity and credentials (who acts), mandates

(under what authority), and attestations (what happened). Privacy is structural: raw health data remains off-chain, while integrity is ensured by cryptographic commitments and revocation-aware verification.

This architecture matches continuous, hybrid care and machine participation. AI agents and care robots are first-class identities, but never sovereign: they operate only under explicit, time-bound, revocable mandates, making machine activity a governed extension of human intent with verifiable proof of action.

The economics reinforce accountability without speculative tolls. Participation requires small, reclaimable DHP deposits (including sponsored onboarding by organisations), with amounts tiered by actor type to deter spam/Sybil behaviour while keeping entry friction low. Predictable, USD-denominated fees fund operations: an additional 10% onboarding fee feeds a shared fee pool that covers Solana rent/onboarding complexity, and each protocol action pays a fixed USD 0.10 into an operations pool for ongoing transaction costs.

DHP is the protocol's asset for participation, accountability, and governance, not a payment coin. Commercial settlement uses stable-value assets. Inflation is **set at 2% annually on Solana-native DHP and is distributed only to active participants,** thereby preserving incentives for real, verifiable protocol work.