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Reilly EternaMark (REM) Protocol - Dual-Layer Digital Permanence Using DOI Archiving and Blockchain Timestamping
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Abstract

The Reilly EternaMark (REM) Protocol defines a dual-layer method for digital permanence through the integration of Digital Object Identifiers (DOIs) and blockchain timestamping. The protocol ensures digital artifacts are permanently identifiable, immutable, and verifiable for both present and future use.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

Existing digital preservation methods are centralized and vulnerable to alteration, corruption, or loss. The REM Protocol addresses these issues by combining DOI persistence with blockchain immutability.

DOI ensures discoverability, persistence, and interoperability. Blockchain timestamping ensures immutability and tamper-proof verification. This creates a dual-layer permanence system suitable for academia, compliance, intellectual property, and AI data governance.

2. Terminology

DOI: Digital Object Identifier, a globally unique and resolvable identifier.

Timestamp: A blockchain-anchored proof of existence and creation time.

Artifact: Any digital object (paper, dataset, contract, etc.) preserved via REM Protocol.

3. Protocol Overview

The REM Protocol consists of four steps:

1. Hashing — Compute SHA-256 hash of the digital artifact. Example: 02439f01ba0b805ba3011aaeb2783ffb096c1c6ad847876e75...

2. Blockchain Timestamping — Submit the hash to a blockchain timestamping service. Example: Bitcoin block 914168 attests existence as of 2025-09-10 EST.

3. DOI Assignment — Register the artifact with a DOI system (e.g., Zenodo). Example: https://zenodo.org/records/17096230

4. Archival Integration — Publish DOI, blockchain TXID, and hash together as the permanent record.

4. Specification

Inputs: Digital artifact.

Process: SHA-256 hash -> Blockchain timestamp -> DOI registration -> Publication.

Outputs: A permanent, verifiable record consisting of: DOI (discoverability), Blockchain TXID (immutability), Hash (integrity proof).

5. Security Considerations

Integrity: Provided by SHA-256 hashing.

Immutability: Guaranteed by blockchain consensus.

Persistence: Ensured by DOI federation and global resolution.

6. IANA Considerations

This document has no IANA actions.

7. Applications

Academic publishing and research archiving.

Compliance (finance, healthcare, logistics).

Intellectual property (true prior art, permanent alternative to patents).

AI and ML datasets (trustworthy sources).

8. Informative References

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