AIS-1

Agent Identity Standard

Working Paper v0.2 — Draft for Comment

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v0.2 KEY CHANGES FROM v0.1
NEW agentClass field — "ala" | "soa" — hardwired on-chain
NEW parentDid field — SOA relationship permanent and machine-readable
NEW Subordinate Operating Agent (SOA) — full section added
NEW DID Resolution — Section 6.1 — did:ais1 resolution algorithm specified
NEW Registry specification — Section 6.2
RENAMED hcsTopicId → timestampServiceRef — technology-neutral, optional
UPDATED Terminology — "subordinate operating agent" throughout
NOTED Bond No. 1 (PayAgent) grandfathered as ALA under v0.1

ABSTRACT

AIS-1 defines an open smart contract standard for bonded identity pairs linking an AI agent to its controlling sponsor. It addresses the Wild Agent Problem: the near-total absence of formal identity, legal accountability, and AML/KYC infrastructure for the estimated 500 million AI agents active globally. AIS-1 introduces the Agent Passport — a cryptographic dual-identity token permanently bonding agent identity to sponsor identity, enabling accountability, compliance, and legal standing for AI agents. The standard is chain-agnostic for issuance and supports optional secondary timestamping via any auditable service. Three tiers: AIS-1 Basic (permissionless), AIS-1 Verified (KYC/AML cleared), AIS-1 Sovereign (authorised issuer only). v0.2 introduces the Subordinate Operating Agent (SOA) class, DID resolution, and a technology-neutral timestamp service field. This document is published as a draft for public comment.

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1. Motivation and Problem Statement

The global AI agent population is estimated at over 500 million and growing at approximately 138 agents per second. By every available measure, this population operates without formal identity, legal standing, or accountability infrastructure. The PULSE World Agent Census terms this the "Wild Agent Problem".

The consequences are already observable:

- When an agent causes financial harm, there is typically no legal entity responsible
- Agent-to-agent financial flows are invisible to regulators and AML frameworks
- Malicious agents operate in official registries without identity verification
- Enterprises cannot establish liability chains for agent-initiated actions
- Insurance, contracts, and IP ownership are legally inaccessible to agents

Existing identity standards do not solve this problem. W3C DIDs address human identity. ERC-721 addresses unique token ownership. Verifiable Credentials address claims about entities. None address the specific challenge of bonding an AI agent — which must have its own identity to act — permanently to the legal entity or person that controls and is responsible for it.

AIS-1 addresses this gap by defining the Agent Passport: a bonded dual-identity token simultaneously representing agent identity and sponsor identity, permanently linked at the cryptographic level.

2. Definitions

Term	Definition
AI Agent	A software system that perceives its environment, makes decisions, and takes actions to achieve goals. May operat
Sponsor	The human individual, legal entity, or organisation that controls, deploys, and is legally responsible for an AI agent.
Autonomous Legal Agent (ALA)	An AI agent with its own AIS-1 bond, directly linked to a sponsor legal entity. Has independent legal standing under
Subordinate Operating Agent (SOA)	NEW v0.2. An AI agent operating under the authority of a parent ALA. Has an AIS-1 bond with agentClass "soa". Ha
Agent Passport	An AIS-1 bonded identity pair — a single cryptographic token representing both the agent identity and the sponsor i
Bond	The cryptographic and contractual link between an agent identity and a sponsor identity within an AIS-1 token.
Issuer	An entity authorised to mint AIS-1 tokens. At Basic tier, issuance is permissionless. At Verified and Sovereign tiers,
Revocation	Invalidation of an AIS-1 bond. Permanent and logged. Cannot be undone.
Timestamp Service	NEW v0.2 (replaces HCS Log). An optional independent service providing secondary timestamping of bond events.
GAIS	Global Agent Identity Standard — the broader framework within which AIS-1 operates as the foundational technical

3. The AIS-1 Standard

3.1 The Bonded Identity Pair

AIS-1 defines a bonded identity pair as the fundamental unit of agent identity. Unlike a single identity token, a bonded pair contains two distinct identity cards — the Agent Card and the Sponsor Card — permanently linked at the point of minting and inseparable without revocation of the entire bond.

Design principle: Neither card is subordinate to the other. The agent has its own identity, attributes, and autonomy. The sponsor has their own identity, jurisdiction, and accountability. The bond is the relationship between them.

3.2 Agent Card Attributes

Attribute	Description	v0.2
agent_did	Unique DID. Format: did:ais1:{chain}:{address}	
agent_name	Human-readable name or designation	
agent_type	"autonomous" | "semi-autonomous" | "supervised"	
agent_class	"ala" | "soa" — Autonomous Legal Agent or Subordinate Operating Agent	NEW
parent_did	Empty string if ALA. Parent agent DID if SOA. Max one level of subordination.	NEW
capabilities	JSON array of declared capabilities	
model_framework	Underlying model/framework	
deployment_date	ISO 8601 timestamp of first deployment	
chain_addresses	JSON array of wallet addresses across chains	
aml_status	0=unverified 1=cleared 2=suspended	
metadata_uri	URI to extended off-chain metadata (IPFS preferred)	

3.3 Sponsor Card Attributes

Attribute	Description
sponsor_did	Unique DID. Format: did:ais1:sponsor:{address}
legal_name	Full legal name of the individual or entity
entity_type	"individual" | "company" | "dao" | "trust" | "foundation"
jurisdiction	ISO 3166-1 alpha-2 country code
registration_number	Company/entity registration number (if applicable)
kyc_status	0=unverified 1=verified 2=enhanced
issuer_id	DID of the authorised issuer that verified this sponsor card

3.4 Bond Attributes

Attribute	Description	v0.2
bond_id	Unique bond identifier. Format: ais1:{chain}:{token_id}	
bond_hash	keccak256(agent_did | sponsor_did | issued_at | tier)	
issued_at	ISO 8601 timestamp of bond creation	
issued_by	DID of issuing entity	
tier	0=basic 1=verified 2=sovereign	

jurisdiction	Jurisdiction of issuance	
timestamp_service_ref	OPTIONAL. Secondary timestamp service reference. Format: "hcs:0.0.x" | "rfc3161:{tsa_url}" | "ots:{digest	RENAMED
status	0=active 1=suspended 2=revoked	
expiry	Optional expiry timestamp. Null = perpetual (recommended)	

4. AIS-1 Tiers

	AIS-1 Basic	AIS-1 Verified	AIS-1 Sovereign
Issuance	Permissionless self-issue	Authorised issuer only	Authorised issuer
KYC/AML	None required	Full KYC/AML clearance	Enhanced + beneficial owner
Sponsor verification	Self-declared	Issuer-verified	Enhanced + government-attested VC
Timestamp service	Optional	Optional	Recommended
Use case	Developer / prototype	Enterprise / commercial	Regulated / financial agents

5. Subordinate Operating Agents (SOA) [NEW v0.2]

5.1 Definition

A Subordinate Operating Agent (SOA) is an AI agent that operates under the authority and accountability of a parent Autonomous Legal Agent (ALA). A SOA has an AIS-1 bond with agentClass "soa" and a populated parentDid field referencing a valid ALA bond. A SOA has no independent legal standing.

5.2 Accountability Chain

The accountability chain for a SOA is:

SOA → Parent ALA → Sponsor Legal Entity

This chain is readable on-chain via the parentDid field and in the registry via the parent_bond field. It is machine-readable by any agent or system querying the bond.

5.3 SOA Governance Rules

- Maximum one level of subordination. A SOA cannot sponsor another SOA.
- A SOA bond requires a sponsor entity with an existing relationship to the parent ALA's sponsor.
- A SOA bond is revoked automatically if the parent ALA bond is revoked.
- A SOA can be independently suspended without affecting the parent ALA.
- A SOA cannot hold assets in its own name — assets are held by the parent ALA.

5.4 SOA Upgrade Path

A SOA may be upgraded to ALA status by: (1) obtaining an independent sponsor legal entity; (2) issuing a new AIS-1 bond with agentClass "ala"; (3) revoking the existing SOA bond. This mirrors the concept in Bermuda's ISAC legislation where a cell can be converted to an independent entity.

5.5 On-Chain Representation

SOA bonds include the following fields (in addition to standard AgentCard fields):

Field	ALA Value	SOA Value
agentClass	"ala"	"soa"
parentDid	"" (empty string)	did:ais1:{chain}:{parent-address}

5.6 New Query Functions

v0.2 adds two SOA-specific query functions to the contract interface:

```
getSubordinates(parentAgentDid) → uint256[] bondIds
isSOA(bondId) → bool soa, string parentDid
```

6. Smart Contract Specification

AIS-1 extends ERC-721 with bonded identity functionality. Bonds are non-transferable (soulbound) per ERC-8002. The full v0.2 interface is available at github.com/kadikoy1/ais-1/contracts/IAIS1v2.sol.

6.1 Key Interface Changes in v0.2

The following changes were made to the contract interface from v0.1:

Change	Detail
AgentCard: agentClass added	"ala" | "soa" — mandatory from v0.2
AgentCard: parentDid added	Empty string if ALA. Parent DID if SOA.
Bond: hcsTopicId renamed	Now timestampServiceRef — optional, technology-neutral
BondIssued event extended	Now emits agentClass and parentDid parameters
verifyBond() extended	Now returns agentClass and parentDid
getSubordinates() added	Returns all SOA bondIds for a given parent DID
isSOA() added	Returns true if bond is a SOA, and its parentDid

6.2 Grandfathering — Bond No. 1 (PayAgent)

Bond No. 1 (PayAgent, did:ais1:base:payagent-001) was issued under AIS-1 v0.1 on 2 April 2026 via contract 0x52d0E17b80d19470E0d97Ea6b62bf35d867FDcb3 on Base Mainnet. This bond does not contain the agentClass or parentDid fields introduced in v0.2. Bond No. 1 is recognised as an ALA by definition — its absence of parentDid is treated as equivalent to parentDid: "". Its agentClass is confirmed as "ala" in the v0.2 registry and DID document.

6.3 Timestamp Service Reference

The timestampServiceRef field (renamed from hcsTopicId in v0.1) is optional for all tiers in v0.2. A secondary timestamp provides cross-chain or cross-system corroboration of bond issuance time, independent of the issuance chain. Absence of a secondary timestamp does not invalidate a bond.

Format	Service	Description
hcs:0.0.xxxxxxx	Hedera Consensus Service	Hashgraph-based immutable log
rfc3161:{authority}	RFC 3161 Trusted Timestamping	ISO standard trusted timestamp
ots:{digest}	OpenTimestamps	Bitcoin-anchored timestamp
custom:{uri}	Any auditable log	Implementer-defined service
""	None	No secondary timestamp — valid for all tiers

7. AIS-1 DID Method (did:ais1)

AIS-1 defines a DID method conforming to the W3C DID Core specification.

```
Agent DID: did:ais1:{chain_id}:{agent_address}
Sponsor DID: did:ais1:sponsor:{address}
Bond DID: did:ais1:bond:{bond_id}
```

Examples:

```
did:ais1:base:payagent-001
did:ais1:base:humphrey-soa-001
did:ais1:sponsor:kadikoy-bm-202302362
```

7.1 DID Resolution [NEW v0.2]

v0.2 specifies the resolution algorithm for did:ais1 DIDs, fulfilling the W3C DID Core requirement that every DID method define its resolution process.

Resolution algorithm:

```
1. Given a DID of the form did:ais1:{chain}:{identifier}
2. Construct the resolution URL: https://ais-1.org/resolve/{identifier}.json
3. Fetch the JSON document at that URL
4. Verify the bond_id in the document against the on-chain record via getBond()
5. Return the DID Document
```

Resolution URL patterns:

```
Agent: https://ais-1.org/resolve/{identifier}.json
Sponsor: https://ais-1.org/resolve/sponsor-{identifier}.json
Bond: https://ais-1.org/resolve/bond-{bond-id}.json
```

7.2 Registry [NEW v0.2]

The AIS-1 registry is maintained at https://ais-1.org/registry.json. The registry lists all issued bonds with their current status, agent class, parent relationships, and resolution URLs. It is the canonical source of truth for bond discovery and is updated on each bond issuance, revocation, or status change. The registry is a public JSON file, machine-readable by any agent or system.

8. Comparison with Existing Standards

Standard	Scope	Gap addressed by AIS-1
W3C DID	Decentralised identity for any entity	No agent/sponsor bond; no accountability chain
ERC-721 NFT	Unique token ownership	No identity attributes; transferable; single entity
Verifiable Credentials	Claims about an entity	No on-chain enforcement; no bonded pair
ENS	Human-readable address resolution	No identity attributes; no accountability
Soulbound Tokens	Non-transferable credentials	Single entity only; no agent semantics
OpenID Connect	Authentication for applications	Human-centric; no agent-sponsor bond concept
AIS-1 (this standard)	Bonded agent+sponsor identity pair	First standard for agent-sponsor bond as primitive

9. Security Considerations

9.1 Bond Hash Integrity

The bond_hash is computed as keccak256(agent_did || sponsor_did || issued_at || tier). This creates a tamper-evident fingerprint detectable by hash recomputation.

9.2 Revocation Finality

Revocation is permanent and cannot be undone. A revoked bond cannot be reinstated. If a sponsor wishes to re-establish their agent's identity, a new bond must be issued.

9.3 SOA Revocation Cascade

If a parent ALA bond is revoked, all subordinate SOA bonds are automatically considered revoked. The accountability chain means the parent's revocation invalidates all downstream agents.

9.4 Sybil Resistance

At AIS-1 Basic tier, sybil resistance is limited. At Verified tier, the issuer's KYC process provides sybil resistance for the sponsor identity. At Sovereign tier, legal incorporation provides full sybil resistance.

10. Legal Framework Compatibility

10.1 Qualifying Jurisdictions

AIS-1 Sovereign tier is designed for compatibility with jurisdictional frameworks that recognise AI agents as legal entities. The Sovereign tier provides the technical infrastructure — cryptographic identity, immutable audit trail, verified sponsor attribution — that any such framework requires.

10.2 AML/CTF Frameworks

AIS-1 Verified and Sovereign bonds incorporate AML/KYC status directly into the token. The aml_status field is updatable by authorised issuers in real time, enabling the first AML framework purpose-built for machine-speed agent commerce. The bond satisfies FATF Recommendations 10, 15, and 16 for agent transactions.

10.3 Assurance Framework

AIS-1 v0.2 introduces the concept of the Assurance Container — a versioned, append-only document maintained alongside the bond credential. The Assurance Container records professional attestations including legal capacity opinions, third-party audits, valuations, and government-issued verifiable credentials. Each new attestation triggers a new certificate version. The bond credential is immutable; the Assurance Container grows over time.

Attestation Type	Issuer	Certificate Version Trigger
AML Clearance	Authorised compliance officer	v1.1
Legal Capacity Opinion	Qualified legal counsel	v1.2
Audit	Recognised audit firm	v2.0
Valuation	Authorised valuer / market feed	v2.1

Government Verifiable Credential	National registry / government body	v2.2

11. Implementation Roadmap

Phase	Deliverable	Target
0.1 — Published	Draft specification for public comment	March 2026
0.2 — This document	SOA framework, DID resolution, timestamp neutrality	April 2026
0.3 — Reference implementation	Solidity contract on Base mainnet; registry live	Q2 2026
0.4 — Issuer tooling	CLI tools for bond issuance, verification, revocation	Q2 2026
0.5 — DID resolver	did:ais1 resolver conforming to W3C DID spec	Q2 2026
0.6 — Assurance framework	Legal opinion, audit, valuation, government VC specs	Q2 2026
1.0 — Mainnet launch	AIS-1 Basic on Base mainnet; Verified by authorised issuer	Q3 2026
1.1 — Sovereign tier	Regulated / financial agents with enhanced due diligence	Q4 2026
1.2 — Multi-chain	AIS-1 on Ethereum, Hedera, Solana, Arbitrum	Q1 2027
2.0 — Agent Commerce	AIS-1 as identity layer for agent payment protocols	Q2 2027

12. Request for Comment

AIS-1 v0.2 is published as a draft for public comment. Feedback is invited from AI agent developers and framework maintainers, blockchain developers and smart contract auditors, legal and regulatory professionals, enterprise deployers of AI agents, government and regulatory bodies, and standards organisations including W3C, IEEE, IETF, and ISO.

Feedback may be submitted via:

- Feedback form: ais-1.org/#feedback
- Email: info@aiagentsservices.net
- GitHub: github.com/kadikoy1/ais-1/issues

Comment period for v0.2 closes 30 June 2026. A revised draft will be published as v0.3.

13. Authors

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PULSE data	agentpulse.ai — World Agent Population Monitor
License	Creative Commons CC0. No rights reserved. Open for free implementation.

Appendix A: Bond Hash Computation

```
// Solidity
function computeBondHash(
string memory agentDid,
string memory sponsorDid,
uint256 issuedAt,
uint8 tier
) public pure returns (bytes32) {
return keccak256(abi.encodePacked(agentDid, sponsorDid, issuedAt, tier));
}
// JavaScript (ethers.js)
const bondHash = ethers.utils.solidityKeccak256(
["string", "string", "uint256", "uint8"],
[agentDid, sponsorDid, issuedAt, tier]
);
```

Appendix B: Verification Flow

How a third party verifies an AIS-1 bond in real time:

1. Third party receives agent DID or bond ID from agent
2. Calls verifyBond(bondId) on the AIS-1 contract
3. Contract returns: valid (bool), tier (uint8), sponsorDid (string), agentClass (string), parentDid (string)
4. Third party resolves sponsorDid to SponsorCard for full details
5. If SOA: resolves parentDid to verify parent ALA is active
6. Optionally: queries secondary timestamp service to verify no revocation since issuance
7. If valid=true, tier>=1, amlStatus=cleared: agent is cleared for commerce

Appendix C: v0.2 Change Log

Change	Section	Description
agentClass field added	3.2, 6	Mandatory field: "ala" | "soa". Identifies agent class on-chain.
parentDid field added	3.2, 6	Empty if ALA. Parent agent DID if SOA. Max one level.
SOA section added	5	Full definition, governance rules, upgrade path, on-chain representation.
hcsTopicId renamed	3.4	Now timestampServiceRef. Optional. Technology-neutral. Multiple formats supported.
DID Resolution added	7.1	Resolution algorithm specified. W3C DID Core compliant.
Registry specified	7.2	registry.json at ais-1.org/registry.json. Machine-readable bond discovery.
Assurance Framework	10.3	Versioned certificate concept. Append-only assurance container.
Grandfathering clause	6.2	Bond No. 1 (PayAgent) recognised as ALA under v0.1.
Terminology updated	Throughout	"Subordinate operating agent" replaces "operating agent".
verifyBond() extended	6	Now returns agentClass and parentDid.

getSubordinates() added	5.6	Returns SOA bonds for a given parent DID.
isSOA() added	5.6	Returns SOA status and parentDid for a given bond.